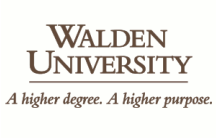

2018

Racial/Ethnic Differences in the Treatment of Elderly Non-Small Cell Lung Cancer Patients

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health, Epidemiology

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Abstract

Racial and ethnic disparities related to lung cancer treatments and outcomes are not fully understood but may be due to individual or institutional factors. Following established national cancer treatment guidelines may improve patients' quality of life, outcome to treatment, and facilitate the eradication of lung cancer. There are limited data on the real-world treatment of racial/ethnic groups with non-small cell lung cancer (NSCLC) according to clinical practice guidelines, therefore this population-based cohort study examined the receipt of first line treatment for advanced or metastatic NSCLC according to the National Comprehensive Cancer Network (NCCN) practice guidelines. The Social Cognitive Theory served as the framework as it focuses on individual cognitive influences and self-efficacy. A retrospective analysis of NSCLC patients ($\geq$ 65 years) was conducted using the linked Surveillance, Epidemiology, and End Results (SEER) data linked with Medicare. Logistic regression models were fit to evaluate the relationships between patient race/ethnicity and the receipt of treatment according to the guidelines within various clinical strata (e.g., histology type, stage of disease). There were no significant differences between Caucasians and African Americans in terms of treatment consistent with guidelines after controlling for other factors. One limitation to this study was the administrative nature of the Medicare database and the limited number of Hispanic patients. This research may contribute to positive social change by supporting a deeper understanding of factors that might influence NSCLC treatment selection. Public health initiatives to promote compliance with treatment guidelines can lead to better outcomes following medical treatments, especially for NSCLC.

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Dedication

This dissertation and the work that has gone into completing it are dedicated to Roger, who has provided constant encouragement and has been an inspiration in my graduate education. Thank you for your patience and tolerating my working at all hours of the night. The journey during this process had its ups and downs and has taken longer than expected. Roger, thank you for your faith in me. Anything is possible with faith, determination, and hard work. Now it is our time to play!

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Chapter 1: Introduction to the Study

Introduction

Lung cancer is the second most common cancer in the United States and is a major health problem, representing 14% of all new cancers (American Cancer Society [ACS], 2018). It kills more patients than breast cancer, colon cancer, and prostate cancer combined (ACS, 2013; Lung Cancer Alliance, 2013, Surveillance Epidemiology End Results [SEER], n.d.) and worldwide contributes to more deaths than HIV, tuberculosis, and malaria (ACS, 2011). Lung cancer is a disease of the elderly. Two out of three individuals with lung cancer are 65 years of age or older with a median age at diagnosis of 70 years, and less than 2% of lung cancer are diagnosed in individuals younger than 45 years of age (ACS, 2014). In 2013, lung cancer was the leading cause of death in men and women in the United States, killing over 160,000 individuals (ACS, 2013b; American Lung Association [ALA], 2014, SEER, n.d.). The World Health Organization (WHO) predicts the number of new cancers overall will grow from 14 million to more than 22 million by 2030 (American Society Clinical Oncology [ASCO], 2014).

The incidence of lung cancer varies by stage of disease and by race/ethnicity. According to the ALA (2010) African American men are diagnosed with lung cancer at a 37% higher rate than Caucasian men while Hispanics have an almost 50% lower incidence of lung cancer as compared to Caucasians, in part due to less smoking (ACS, 2012). Overall, African Americans have a higher cancer incidence rate than other racial and ethnic groups and a mortality rate that is approximately 30% higher than Caucasians (ACS, 2013; ALA, 2010; Office of Minority Health, 2013, SEER, n.d.). The incidence of

patients diagnosed with advanced stage IIIB lung cancer is 17.6% and 40% with metastatic stage IV disease (National Cancer Institute [NCI], 2011).

The mortality rates for most major cancers such as colon, breast, and prostate have been decreasing; however, the lung cancer mortality rate, though it has decreased due individuals quitting smoking, has not decreased as fast over the past decade (Lung Cancer Alliance, 2012). The 2013 Cancer Facts and Figures statistics show that the lung cancer death rate for African Americans has declined faster than Caucasians (2.4% vs. 1.9%) due to more African Americans quitting smoking, but there still remain differences in lung cancer mortality between African American, Hispanic, and Caucasian populations (ACS, 2013). The differences in lung cancer mortality between Caucasians and African Americans are the result of a number of factors, including differences in access to care, quality of care, bias in treatment, stereotyping, and socioeconomic status (SES; Clark, 2009). Lower SES is frequently associated with lower health literacy and the ability to understand healthcare information (ASCO, 2014). In fact, an analysis of the data reveals that racial disparity has not decreased in the10 years from 1992 to 2002 (Gross, Smith, Wolf, & Andersen, 2008). This fact has been confirmed by other studies (Kaiser Family Foundation, 2012).

Much of the research contributing to the understanding and elimination of disparities has focused primarily on the best-known factors associated with the determinants of health such as race/ethnicity and SES (Berkowitz & McCubbin, 2005). Healthcare disparities related to societal marginalization, patient distrust of the medical community, and institutional discrimination are known to be present (Anderson, 2014).

Patients who are marginalized have been shown to experience delays in the diagnosis and treatment of their cancer and are less likely to receive recommended treatment options leading to decreased survival (Anderson, 2014). Additional research in these areas of health care processes and quality of treatment and care may contribute to our understanding and help eliminate the disparities experienced by many racial/ethnic minorities (Gross et al., 2008). The Institute of Medicine (IOM) highlighted the need to avoid ineffective care and to increase the use of practices with proven evidence (Smedley, 2003). In an effort to reach the IOM goal, President Clinton initiated the *Racial and Ethnic Health Disparities Initiative* and set the goal of eliminating racial disparities by 2010 (Health and Human Services, 1998). Because the United States did not meet the goal of eliminating the multifaceted problem of health care disparity by 2010, solving this problem remains a focus for the United States. While the United States is known to have one of the best health systems, evidence shows there is inconsistent care given to cancer patients and that African Americans are less likely than Caucasians to receive stage appropriate treatment for lung cancer (American Society of Clinical Oncology (ASCO), 2013; Betancourt & Renfrew, 2011; IOM, 2013; Shugarman et al., 2009).

One strategy to aid in reducing the disparities in cancer treatment between racial/ethnic groups is to use evidence-based clinical practice guidelines that are disease specific. The National Comprehensive Cancer Network (NCCN) clinical practice guidelines are the most widely accepted and used cancer guidelines and have been shown to improve the quality of care in cancer patients by providing the physician with the best

clinical evidence available from randomized clinical trials for treating a cancer (ASCO, 2013; NCCN, 2014; Smith, 2000). The NCCN clinical practice guidelines were developed by experts from a number of major cancer centers in the United States using an unbiased process for evaluating clinical trial data and the clinical research literature in an effort to aid in the treatment decision-making process. The NCCN clinical practice guidelines are classified into categories (Category 1, 2a, 2b, and 3) by the strength and consistency of the evidence and the consensus panel agreement to the recommended guidelines. Clinical practice guidelines and standards of care change over time depending on the data released from clinical trials. The current recommended guideline for stage IIIB non-small cell lung cancer (NSCLC) is concurrent chemoradiation and for first-line stage IV NSCLC is a two-drug combination of a platinum drug (either carboplatin or cisplatin) plus another drug such as docetaxel, gemcitabine, pemetrexed, paclitaxel, or vinorelbine. The addition of a biologic drug such as bevacizumab is indicated for patients with nonsquamous NSCLC. Following the recommended clinical practice guidelines provides the scientific basis for medical treatments, providing for consistent practices among physicians, increasing quality care while allowing for fewer treatment differences between patients, increasing efficiency, and lower costs. Overall, the guidelines provide a roadmap for treatment but are not mandatory as physicians are able to make certain clinical decisions based on each patient's overall medical condition. As the cost of the new therapeutic agents adds to the overall cost of treatment, it is key that the clinical practice guidelines are incorporated into treatment decisions because clinical practice guidelines are used for reimbursement by payers and for advocating for

policies to ensure access to cancer care. The relationship between the provider and the patient may also be improved if there is a discussion about clinical practice guidelines and involving the patient in their own care allowing for improved treatment compliance. The NCCN clinical practice guidelines are available for 97% of cancers and can be applied to approximately 97% of the population in the U.S. (NCCN, 2014). However, having clinical practice guidelines available does not ensure that they will be used because the guidelines are not mandatory (Mok, 2014).

The goal for this research was to retrospectively evaluate the specific cancer treatment of elderly African Americans, Caucasians, and Hispanics with advanced stage IIIB or stage IV metastatic NSCLC using a national database from the NCI to evaluate treatment according to the NCCN clinical practice guidelines. The results from lung cancer research and health outcomes research in the early stages of NSCLC demonstrated differences in the rate of surgery in African Americans and Caucasians. However, there is limited research on lung cancer treatment in Hispanics, as well as on lung cancer treatment patterns in the advanced stage of the disease comparing Caucasians, African Americans, and Hispanics (Shavers & Brown, 2002). There is also little to no data on the use and effect of clinical practice guidelines in lung cancer across racial/ethnic groups. Therefore, the focus of this study was to evaluate the treatment of elderly Hispanic patients diagnosed with advanced/metastatic NSCLC compared to African Americans and Caucasians and the use of lung cancer clinical practice guidelines in the treatment of NSCLC.

This study contributed to the body of research in lung cancer disparity as it related to the treatment of different ethnic groups according to the recommended treatment guidelines established by NCCN. If patients are not treated according to the recommended lung cancer guidelines for stage of disease, treatment differences may be exaggerated. While it was difficult to determine the reason treatment was not provided according to the clinical treatment guidelines, this research provided an understanding of the treatment in NSCLC in African Americans, Hispanics, and Caucasians and provided insight into whether physicians may be contributing to disparities by potentially not following the clinical practice guidelines. Having an understanding of cancer treatment patterns between racial/ethnic groups may allow the healthcare community to better understand the potential causes for the disparities and identify strategies for eliminating the disparity. Social change can be achieved through improving the understanding of racial disparities, increasing awareness, and educating healthcare providers around racial/ethnic differences and cultural sensitivity toward these groups.

This chapter provides the background on health disparity in lung cancer between African Americans, Hispanics, and Caucasians with regards to the first line treatment of advanced NSCLC. I will introduce the problem statement, the purpose of the study with research questions and hypotheses, definitions of terms, and the limitations to a retrospective study using a large population database. Clinical practice guidelines provide healthcare providers with a resource for more consistent treatment across racial/ethnic groups and ensure that the most current research discoveries are incorporated into patient treatments. However, there tends to be variation in the use of

these guidelines across disease entities. Therefore this study helped determine the extent to which clinical practice guidelines were used in the first line treatment of advanced/metastatic NSCLC in the elderly and address the needs for additional research.

Background

Lung cancer is a devastating disease and its incidence is expected to increase worldwide over the next decade (ACS, 2014). Currently there are 1.6 million deaths annually worldwide due to lung cancer and the WHO predicts a 70% increase in cancer by 2030 (WHO, 2014). Eighty percent of lung cancers are diagnosed in current and former smokers, in addition to individuals exposed to second hand smoke and environmental pollutants, which also increase the risk of developing lung cancer. Smoking is the leading cause of preventable cancer mortality in the United States and worldwide (CDC, 2008). Approximately 56% of lung cancers are diagnosed once they have spread to other parts of the body (Lung Cancer Alliance, 2013). The overall 5-year survival rate for lung cancer is approximately 16%, which is less than the 5-year survival for the other major cancers in the United States, including breast, colon, or prostate cancer (Lung Cancer Alliance, 2013; SEER, n.d.). With regards to lung cancer mortality and general cancer mortality, lung cancer represents 27% of all cancer deaths in the United States (SEER, n.d.). African Americans have the highest mortality rates from cancer, including lung cancer. The cancer mortality rate for African American men between 2003 and 2007 was 296/100,000 compared to 225/100,000 for Caucasians (ASCO, 2013).

Disparities in cancer mortality have been well documented in the medical and public health literature. In 2002, the IOM published a report describing the disparities in healthcare between racial/ethnical groups and outlined multiple factors that contributed to the differences, including socioeconomic status, insurance status, access to healthcare, the healthcare provider, and the healthcare system, among other factors. Even when controlling for socioeconomic status, insurance status, and access to healthcare, the research has shown that there has not been an improvement in cancer disparities; however, there has been a slow improvement in the quality of care for some cancer patients due to newer treatments (ASCO, 2013; Rust & Cooper, 2007). But the greatest opportunity for improving disparities in healthcare exists in the healthcare system (Kilbourne, Switzer, Hyman, Crowley-Matoka, & Fine, 2006). Multiple factors within the healthcare system contribute to cancer disparity, including patient delays in obtaining care, physician delay in treatment, patient-physician interaction, lack of minority patient providers within the healthcare system, and the regulations, policies, and resources within the hospital, academic center, or clinic organization (Smedley, 2003).

Since the publication of the IOM report on healthcare disparities, research has been dedicated to determining the reasons for the differences in healthcare treatment and outcomes. Several definitions of disparities are used in the literature. The IOM defined disparities as "the difference in healthcare services received by different racial/ethnic groups that is not due to clinical need/appropriateness or preference by the individual" (Smedley et al., 2003. Freeman and Chu (2005) described the causes for disparities in cancer care and outcomes as culture, poverty, and social injustice. Cultural barriers occur

when there are certain beliefs about cancer and treatment and when there is a lack of information and understanding about cancer. To overcome some of the barriers of culture, poverty, and social injustice Freeman and Chu reference the use of patient navigators. Freeman and Chu also found that the healthcare provider might be contributing to the disparities between patients because, when healthcare providers treat patients, there is an inconsistency between what the provider knows and what the provider provides to the patient. Betancourt and Renfrew (2011) and Kilbourne et al. (2006) found that poor communication between the patient and the healthcare provider, stereotyping/bias, the clinical decision process, and patient mistrust were causes for the differences in healthcare. By applying equal treatment to all patients treatment inequalities can be reduced.

One hypothesis for the causes of the disparities between racial/ethnic groups comes from the social cognitive theory (SCT). The SCT has been used to understand physician actions, physician attitudes, and unconscious thinking process. Research has found that stereotyping by healthcare providers contributed to the differences in treatment between racial/ethnic groups (Burgess, 2010; Burgess et al., 2004). Physicians are taught to eliminate their personal judgment about patients; however, research has found that physicians unconsciously assign patients to a category, which influences treatment decisions, leading to differences in treatment patterns (Burgess et al., 2004; Kilbourne et al., 2006).

Problem Statement

The incidence and burden of lung cancer varies considerably according to the demographic characteristics of patients, especially age, gender, and race/ethnicity. While Hispanic men and women have one of the lowest incidences of lung cancer, African American men have the highest incidence of lung cancer with 95.8 cases per 100,000 persons per year, compared to Caucasian men (74.5 cases/100,000 persons per year) and Hispanic men (40.6 cases/100,000 persons per year; ACS, 2012; SEER, n.d.). Hispanic women have the lowest incidence of lung cancer with 26.3 cases per 100,000 persons per year as compared to African American women 38.0/100,000 and Caucasian women 40.0/100,000 (ACS, 2013; SEER, n.d.). Overall, five-year survival rates for African Americans are also lower than those observed in Caucasians or Hispanics, 12.4% as compared to 15.9% for Caucasian and 14.4% for Hispanics (ACS, 2012; ALA, 2010). Despite low incidence rates, lung cancer is the leading cause of death among Hispanic men and the second leading cause of cancer death among Hispanic women (ACS, 2012). While there have been advances in the treatment of lung cancer and a decrease in the incidence and mortality rates, the decreased rates have not been seen across all races/ethnicities with African Americans still having a disproportionate burden of cancer in the United States (Betancourt & Renfrow, 2011; Freeman & Chu, 2005; National Cancer Institute, 2008; Office of Minority Health, 2013). Patients with metastatic stage IV NSCLC that has spread outside of the lungs are usually treated with chemotherapy to control their disease (NCI, 2013; NCCN, 2014). The treatment of lung cancer in the context of the clinical trial setting is well documented in the literature; however, there are

few data on how patients with advanced stage IIIB/metastatic stage IV lung cancer are treated in the real world outside of the clinical trial setting (Reilly & Evans, 2006). While the NCCN clinical practice guidelines for NSCLC have been in place since 1996 (NCCN, 2014), it is not known if the treatment outside of a clinical trial in the advanced/metastatic first-line setting is equal across all demographic and clinical subgroups with similar stage of NSCLC or to what extent the NCCN lung cancer clinical practice guidelines are applied across different groups of patients.

In the clinical trial setting, patient inclusion/exclusion are generally well defined and well controlled for comorbidities and concomitant medications; however, these variables are not well controlled in the real world, which illustrates the difference between treatment in a clinical trial and real world treatment. It remains unclear if treatment and outcome disparities are due to the individual patient or to institutional factors. Therefore, the purpose of this study will be to fill this gap in the literature and evaluate how advanced stage NSCLC treatments compare across racial/ethnic groups (i.e., African Americans, Hispanics, and Caucasians) as stratified by stage of disease and histology according to the NCCN clinical practice guidelines while controlling for age and gender.

In this study, I evaluated the relationship between first-line treatment for advanced/metastatic NSCLC between African American, Hispanic, and Caucasian individuals age 65 years and older and patients characteristics such as age, gender, stage, and histology according to clinical practice guidelines. As the Hispanic population in the United States increases, their inclusion in research efforts becomes more important. I

evaluated lung cancer treatment according to established guidelines by race/ethnicity, stage of disease, histology, geographic location, and age in order to determine potential variation in treatment and identify ways to improve treatment outcomes. The implication for positive social change from this research included an improved understanding of the treatment trends for first-line metastatic NSCLC, particularly in Hispanics, and a better understanding of the population at the highest risk of lung cancer mortality. This understanding has implications for changing public policy and insurance reimbursement. This study was important to conduct, as it is well known that disparities in the early treatment of NSCLC exist; however, there are limited real-world data available regarding the treatment patterns. There is also limited real-word data across race/ethnicity regarding the treatment of patients in the later stages of lung cancer.

Purpose of the Study

The purpose of this retrospective quantitative research study was to determine the relationship among Caucasian, African American, and Hispanic race/ethnicity, as stratified by histology (squamous vs. adenocarcinoma), and stage of disease (IIIB or IV) to the receipt of first-line treatment for NSCLC. Within each of the four strata (stage IIIB disease adenocarcinoma or squamous cell carcinoma and stage IV disease adenocarcinoma or squamous cell carcinoma), I controlled for age and gender. Treatment according to the clinical practice guidelines was defined as the use of a recommended chemotherapy, radiation therapy, biologic agent, or combination of these therapies appropriate for the stage of disease and histology.

Research Questions and Hypotheses

To better understand the treatment patterns of elderly African Americans and Hispanic patients relative to Caucasians with NSCLC, I explored the following research question and tested hypotheses to address the questions across the three ethnic groups. Each of the following hypotheses was tested within the respective stage and histology, creating a total of four strata. The four strata were (a) stage IIIB adenocarcinoma; (b) stage IIIB squamous cell carcinoma; (c) stage IV adenocarcinoma; (d) stage IV squamous cell carcinoma.

Research Question: What is the likelihood of Caucasian, African American, and Hispanic patients with NCSLC being equally treated according to the NCCN clinical practice guidelines within stage and histology strata after controlling for age and gender?

*Null Hypothesis (H_0)**:*** Caucasian and African American patients with NSCLC are equally likely to be treated according to the NCCN clinical practice guidelines within stage and histology strata, after controlling for age and gender.

Alternative Hypothesis (H_1): Caucasian and African American patients with NSCLC are not equally likely to be treated according to the NCCN clinical practice guidelines within stage and histology strata after controlling for age and gender.

2. What is the likelihood of Caucasian and Hispanic patients with NSCLC being equally treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender?

Null Hypothesis ($H2_o$): Caucasian and Hispanic patients with NSCLC are equally likely to be treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender.

Alternative Hypothesis ($H2_1$): Caucasian and Hispanic patients with NSCLC are not equally likely to be treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender.

3. What is the likelihood of Hispanic and African American patients with NSCLC being equally treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender?

Null Hypothesis ($H3_o$): Hispanic and African American patients with NSCLC are equally likely to be treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender.

Alternative Hypothesis ($H3_1$): Hispanic and African American patients with NSCLC are not equally likely to be treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender.

Theoretical Framework

Many factors influence racial/ethnic disparities, and as such, researchers have used numerous theories to evaluate the differences, with no one overarching theory being used to describe the healthcare differences seen among different groups. The theory that served as the foundation for this study in the use of clinical practice guidelines in NSCLC between racial/ethnic groups was the SCT by Bandera. SCT posits that one's behavior is based on environmental factors such as educational training, colleagues, family and

friends, and observation, as well as personal factors such as cognitive and emotional factors that all interact with each other (Burgess et al., 2004). SCT has two components based on past experiences, one is cognition, and the other is motivation. These components have been used in previous cancer research to evaluate how individuals acquire their learning and how one's past learning and past behaviors influence treatment patterns. SCT has been used to determine an individual's self-efficacy in treating individuals of difference racial/ethnic backgrounds (Burgess et al., 2004).

SCT has been used to consider one's thought processes, one's judgment, and one's social influences in understanding racial/ethnic interactions in healthcare decisions. If a healthcare provider believes that a patient or caregiver is less likely to adhere to a recommended treatment or lacks support from family or friends, the healthcare provider may not prescribe the therapy but instead prescribe a more appropriate therapy (van Ryn & Fu, 2003). Burgess et al. (2010) state that, when physicians interact with racial/ethnic minorities, the physician may experience anxiety, which in turn affects their ability to make treatment decisions. There is also some evidence to suggest that the health system contributes to disparity and that interventions to eliminate disparities can be improved by providing treatment decisions that are less demanding and less mentally intense (van Ryn & Fu, 2003). The factors that contribute to healthcare disparity include the patient, the physician, the patient-physician interaction, third party payers, referral patterns of physicians, and the guidelines within the hospital, academic center, or clinic organization (Kilbourne et al., 2006, Figure 1). Institutional clinical practice guidelines may or may not be in place that physicians follow when treating their patients (Yorio, Yan, Xie, &

Gerber, 2012). Clinical treatment guidelines provide the physician with the tools to treat cancer patients equally according to the best available evidence-based research and make decisions that are less demanding and intense, thereby helping to eliminate treatment disparity.

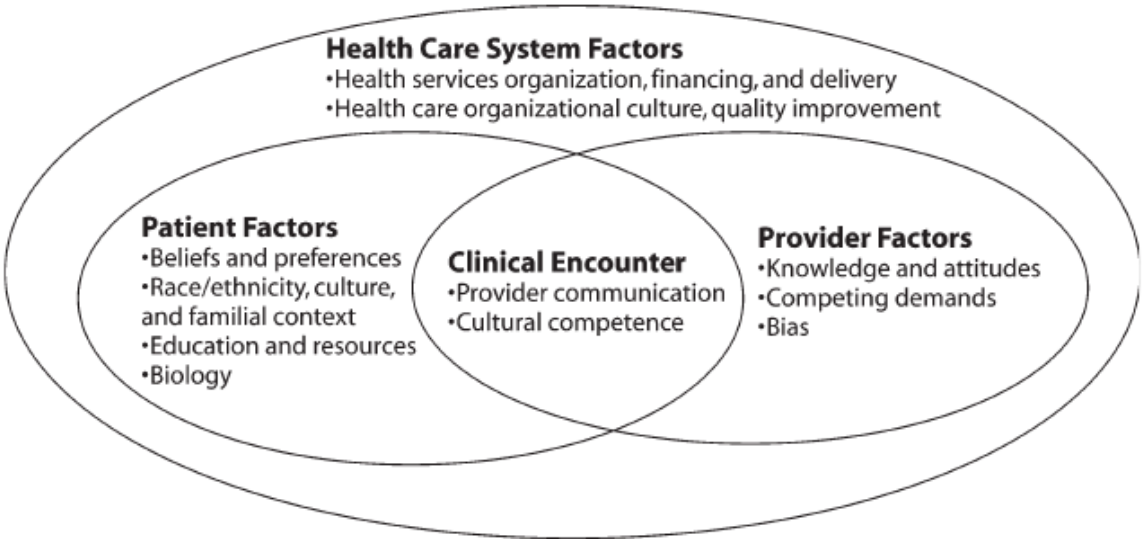

Figure 1. A Conceptual Framework Describing Healthcare Disparities. From "Advancing health disparities research within the health care system: A conceptual framework," by A. M. Kilbourne et al., 2006, *American Journal of Public Health, 96*, p. 2116. Reprinted with Permission.

Nature of the Study

This study was a retrospective quantitative analysis of the treatment of elderly African Americans, Hispanics, and Caucasians with advanced stage IIIB and metastatic stage IV NSCLC using a secondary data source from the NCI (described below). In this study, I tested whether there are differences in the chemotherapy, radiation therapy, or biologic therapy administered in the first line treatment of African American and

Hispanic patients with NSCLC as compared to Caucasians. All patients had stage IIIB/IV NSCLC and comparable stage of disease. I identified and stratified patients by stage (IIIB or IV) and lung cancer histology (squamous or nonsquamous histology). Age and gender were controlled for using multivariable analyses. The criterion variable was cancer treatment according to the NCCN clinical practice guidelines and the predictor variables were age, gender, and race/ethnicity (African American, Hispanic, or Caucasian). Analyses were performed within stage and histology strata given the differences in treatment guidelines across these groups. All patients were Medicare recipients and had comparable insurance coverage. The study was based on practice guidelines for advanced/metastatic NSCLC using the 2008 NCCN practice guidelines for patients diagnosed with NSCLC between 1998 and 2008 and the 2010 practice guidelines for patients diagnosed from 2008 and 2010. The outcomes were reported as whether the treatment given followed the recommended NCCN clinical practice guidelines according to stage and histology.

Data Source

The NCI initiated the SEER program in 1972. SEER collects data from population-based cancer registries in the United States based on cancer incidence and prevalence, geographic location, cancer survival rates, and cancer mortality rates representing 28% of the U.S. population from 18 U.S. cancer registries (SEER, 2013c; Warren et al., 2002). The SEER database contains 250,045 patients with lung cancer diagnosed from 1991 to 2009 (SEER, n.d.). In 1991, the NCI and the Centers for

Medicare and Medicaid Services (CMS) began linking the SEER registry data with Medicare claims data.

The lung cancer patients for this study were abstracted from the NCI SEER linked Medicare database and included cancer cases reported in SEER from 1998-2011 and Medicare claims from 1991-2010. I selected the SEER database because it is the standard cancer research tool for healthcare researchers who are studying health patterns and outcomes (Abel, 2011; NCI, 2013). Furthermore, the SEER database contains a high racial/ethnic mix and the database population has a similar education and socioeconomic mix to the general population (Abel, 2011). SEER data are available on age, gender, ethnicity, and year of cancer diagnosis for 26% of African Americans, 38% of Hispanics and 25% Caucasians (SEER, 2013c). Hispanic ethnicity in SEER is determined through a Hispanic surname algorithm from the North American Association of Central Cancer Registries Hispanic Identification Algorithm that was developed for enhanced sensitivity compared to what was recorded in the Medicare database (SEER, n. d.). The Medicare database contains claims information on healthcare procedures and utilization in individuals 65 years of age and older with data available for the years 1991-2010. The SEER and Medicare linked databases were used to identify specific chemotherapy agents to treat lung cancer and to identify patterns of lung cancer care according to clinical practice guidelines. Additional focus was on newer agents approved from 1998-2010 as these drugs are widely used by oncologists and are part of the standard of care for treating NSCLC. Claims data were evaluated starting in 1998, when several chemotherapeutic agents were approved for lung cancer. The Food and Drug Administration (FDA)

approved paclitaxel (Taxol) for use in NSCLC in 1998 and docetaxel (Taxotere) was approved in 1999 for NSCLC as a single agent. The FDA approved pemetrexed (Alimta) for NSCLC in 2004 and bevacizumab (Avastin) was FDA approved in 2006 for unresectable adenocarcinoma NSCLC. Erlotinib (Tarceva), an oral chemotherapeutic agent was FDA approved for the first-line treatment of advanced or metastatic NSCLC in 2013. Only chemotherapy administered claims data were evaluated to determine how these new biologic/targeted agents were used in elderly Caucasians, African Americans, and Hispanics diagnosed with NSCLC.

Definition of Terms

An understanding of the terms and acronyms used throughout the lung cancer and disparities literature are important for understanding this research. Following are the definitions of the acronyms and terms used in this research.

African American: An individual who is descended from any of the Black populations in Africa. Also includes individuals from Haiti and Jamaica (U.S. Census Bureau, 2010).

Caucasian: An individual of White race and has European, Middle Eastern or North African origins (U.S. Census Bureau, 2010).

Clinical practice guidelines: Treatment recommendations based on a methodical review of clinical evidence to optimize patient care (Institute of Medicine, 2011).

Disparity: Increase in the incidence, prevalence, burden of disease, and death from disease in a population as compared to the general population (NCI, 2013).

First-line therapy: The first treatment recommended for a disease and is usually the standard treatment based on clinical guidelines (NCI, n.d.).

Hispanic: A person of Mexican, Puerto Rican, Cuban, Central, or South American, or other Spanish culture (U.S. Census Bureau, 2010).

Metastatic: Cancer that has spread to another part of the body, outside of its original site (NCI, 2013).

National Comprehensive Cancer Network (NCCN): A group of 23 cancer centers in the United States that develop clinical practice guidelines that will improve the quality and effectiveness of cancer care for patients (NCCN, 2014).

Non-small cell lung cancer (NSCLC): Type of cancer that originates in the bronchus of the lung and is defined by the appearance of the cells (ACS, 2014).

Overall survival rate: The percentage of people who are still alive after they are diagnosed with cancer or started treatment for a disease (NCI, n. d.).

Randomized clinical trial: A study in which the participants are assigned by chance to separate groups that compare different treatments. Neither the researchers nor the participants can choose the group (American Association for Cancer Research [AACR], 2011).

Stage of disease: The amount of cancer and whether the cancer has spread from the original site of diagnosis to another part of the body. The stages of cancer differ for each cancer type and with the staging system (AACR, 2011).

Standard of care: The currently accepted and widely used treatment for a particular cancer based on previous clinical research (AACR, 2011).

Social cognitive theory (SCT): A model that states individuals learn and gain knowledge based on experience, motivation, observing others, and interactions with others (Pajares, 2002).

Self-efficacy: An individual's capability to succeed in a particular situation (Bandura, 1977).

Targeted agents: A treatment using drugs or other agents that attack specific cancer cells while limiting the effect on normal cells (AACR, 2011).

Tumor board: A group of physicians and healthcare providers from different cancer specialties who discuss a patient medical case and options for treatment (Scher, 2012).

Assumptions

One of several assumptions made for this study was that the study data were representative of the lung cancer population in the United States over 65 years of age. It was also assumed that differences in treatment outcomes would be due to noncancer health and co-morbidities. It was further assumed that the stage of lung cancer and histology would be sufficient to determine appropriate lung cancer care. It was also assumed the data from the SEER-Medicare database were complete and accurate, and that racial/ethnic classifications were accurate.

Scope and Delimitations

The strengths of this study are that this is a large retrospective population-based study using the SEER database that collects data representing 28% of the U.S. population. The combined SEER database and the Medicare database provided for a

more complete analysis of the data and allowed for identifying chemotherapy treatments as compared to using the SEER database alone. SEER collects data from hospitals, physician offices, clinics, nursing homes, and radiation facilities and is able to capture approximately 99% of all cancers (NCI, 2012).

This was a retrospective study and was limited as to why a specific treatment was not given. It would be difficult to determine whether the treatment was not given because of patient refusal, whether the physician did not offer the treatment, or because comorbid conditions existed. Because the population studied was aged 65 years and older with Medicare the results cannot be generalized to the general population. The use of a Medicare database limits this research to only patients with Medicare Part A and Part B and results from this study may not apply to commercially insured patients or patients treated in a Veterans Affairs facility. Also, because this study was an evaluation of patients with advanced/metastatic NSCLC, the results cannot be generalized to patients with earlier stage disease. The SEER-Medicare database does not contain data on the patient performance status, one of the indicators oncologists use when making treatment decisions. SEER represents approximately 28% of the U.S. population; therefore, local treatment differences may not be reflected in this study. Another limitation may be the misclassification of a patient's ethnicity, particularly Hispanic ethnicity, in cancer registries and in the SEER database. Accounting for missing variables is a limitation to conducting a retrospective study. Dummy variables were used to help control bias.

Inclusion/Exclusion Criteria

Participation was delimited to patients with a diagnosis of advanced stage IIIB or stage IV metastatic NSCLC who are Caucasian, Hispanic, or African American; are age 65 or older; and are enrolled in Medicare Part A and Medicare part B insurance upon being diagnosed with NSCLC. The Medicare database does not include patients with Medicare insurance Part C (HMO/PPO); therefore, these patients were not included in the study. As well, patients who may have been diagnosed with another cancer prior to lung cancer, except non-melanoma skin cancer were excluded from this study. Patients with stage I-IIIA NSCLC at diagnosis and patients with histology other than adenocarcinoma or squamous cell carcinoma were also excluded from study because disparities in patients with early stage disease had been fairly well studied.

Significance of the Study

Previous research has shown that when patients have similar insurance status, there are differences in care received between racial/ethnic individuals. Clinical practice guidelines in oncology have been developed for most all tumor types and are available to all healthcare professionals. Following clinical practice guidelines allows for more consistent patient care with less risk of inappropriate care and increased costs (Field & Lohr, 1992). This study helps advance the knowledge of cancer disparities by focusing on the healthcare system as a factor contributing to the gap in cancer care. While it is well known that differences in the receipt of health care exist among minority groups due to lack of insurance or access to care, this research was focused on understanding other factors that contribute to the gap in health care and outcomes by evaluating the use of

clinical practice guidelines in patients with advanced/metastatic NSCLC with similar insurance status. By focusing on factors contributing to the gaps in patient care from the health system, additional insight may be gained to explain the disparities seen and provide the potential for additional prospective research evaluating the health care system as a factor contributing to differences in cancer care.

Summary

There are challenges to reducing the gaps in health care and outcomes among racial/ethnic groups. Eliminating these disparities is a goal of most public health professionals and is also one of the goals for Healthy People 2020 (Healthy People, 2010).

Much of the research in health disparities has focused on social determinant factors with less emphasis on the health care system as a contributor to the disparities in care. Even when SES, insurance status, access to care, and stage of disease are equal, gaps in the health outcomes remain. Racial/ethnic minorities receive lower quality care and have lower health outcomes. Research from Burgess (2002, 2010) and van Ryn (2002) suggested that physician behaviors and bias may contribute to disparities. Researchers have also documented discordant relationships between physicians and patients. Physicians' unconscious stereotypes and biases may be affecting self-efficacy, communication with patients, and adherence to recommended practice guidelines (Burgess et al., 2010). Improving quality of care may improve the communication between the patient and physician and facilitate a mutually shared treatment decision-making process, where the physician is not solely held responsible for the treatment

decisions. Improving patient care through evidence-based medicine and reducing costs with greater efficiency may be possible. Clinical practice guidelines provide evidence-based recommendations appropriate for stage of disease and can potentially increase physician self-efficacy when interacting with racial/ethnic minorities.

In Chapter 2, I will outline the study framework described in Chapter 1 in further detail by providing a thorough review of literature on relevant concepts and theories and literature related to the research questions, hypotheses, the problem statement, and the study objective. In addition, I will provide a historical perspective of lung cancer treatment in Chapter 2. Chapter 3 will include a description of the nature and design of the study, the patient population with justification for the sample size, the research methodology, and the research techniques relevant to data collection and analysis.

Chapter 2: Literature Review

Introduction

Lung cancer is a major health problem in the United States. In 2012, there were approximately 226, 000 new cases of lung cancer diagnosed with approximately 112,000 deaths due to the disease (NCCN, 2014). African Americans have the highest incidence rate of lung cancer at 75/100,000 as compared to Caucasians at 64/100,000, and Hispanics have the lowest incidence of lung cancer at 32/100,000 (ALA, 2010). There are numerous studies to confirm the association between cigarette smoking and lung cancer with the majority of lung cancers that develop in smokers being preventable. Lung cancer is usually diagnosed in the sixth or seventh decade of life and in the advanced stage of disease when the prognosis is poor and when the disease is rarely curable (ALA, 2010). NSCLC and small cell lung cancer (SCLC) represent the two major types of lung cancer with non-small cell lung cancer representing 85% of all lung cancer cases (ALA, 2010). Overall, most minorities have higher incidence rates, higher mortality rates, and lower 5-year survival rates after being diagnosed with cancer as compared to Caucasians (ACS, 2013; ASCO, 2013). Despite treatment with chemotherapy, radiation, and newer targeted agents, lung cancer still has a higher mortality rate as compared to other cancers (ALA, 2013). According to the ACS (2009), as the technologies and therapies to treat cancer improves, racial/ethnic disparities may also increase.

Major advances in the treatment of lung cancer have occurred in the past 30 years, yet not all individuals share equally in receiving cancer care (Freeman & Chu, 2005;

Lillie-Blanton et al., 2008). Cancer care is complex. There are multiple factors that directly impact the patient and that contribute to the disparities in cancer care seen between African Americans, Hispanics, and Caucasians. These factors include lack of education, lack of access to care, environmental factors, racism, the type of health insurance, and the overall healthcare system (Betancourt et al., 2011). Differences in referral patterns to a cancer specialist and differences in the level of insurance coverage may determine the type of treatment given. Patients with a lower level of benefit may not receive the same treatment as a patient with a higher level of the same insurance benefit (Slatore, Au, & Gould, 2010). These differences may also be due to the type of facility where treatment is received and constraints within the healthcare facility such as reimbursement and available resources (Kilbourne et al., 2006). The IOM published a landmark paper entitled "Unequal Treatment: Confronting Racial and Ethnic disparities in Healthcare" that reported on the disparities seen in healthcare and on the factors that contributed to the disparities (Smedley et al., 2003). Minorities tended to receive poorer quality of care than nonminorities even when there was equal insurance and income level (American College of Physicians, 2010; Betancourt & Renfrew, 2011; Clark, 2009; Smedley et al., 2003). Factors contributing to the disparities included poor communication between the patient and the healthcare provider, stereotyping/bias by the healthcare provider, and historic treatment practices that may have caused African American patients to mistrust the healthcare provider and the healthcare system (Betancourt & Renfrew, 2011; Meyers, 2007; Smedley et al., 2003). Differences in care were noted between teaching and nonteaching hospitals, referrals to specialty physicians,

and the availability of translators to aid in communicating with the healthcare provider. Data from the literature also show that other factors contributing to the increased mortality and disparities in lung cancer are stage of disease at diagnosis and the effective treatment of the disease (Li et al., 2011). In addition, the IOM noted that healthcare providers might contribute to the differences in care through their own beliefs about race and subconsciously decide how to treat the patient (Smedley et al., 2003). In a follow-up report, Clark (2009) noted that little to no progress was made in providing access and quality care toward eliminating healthcare disparities since the 2003 IOM report. These themes from the IOM paper have been documented over the years. Forty years after the first healthcare disparities paper was published, suboptimal cancer treatment for many patients still exists (Lillie-Blanton et al., 2008).

In an effort to reduce the lung cancer death rate and improve the treatment of cancer patients, Healthy People 2020, a national initiative from the U.S. Department of Health and Human Services, set the cancer goals of reducing the overall cancer death rate and reducing the lung cancer death rate in individuals by 2020 (Healthy People 2020, 2013). However, if healthcare disparities are to be eliminated, the cause of the disparities must be understood. Therefore, the purpose of this study was to conduct a retrospective evaluation of patients with advanced NSCLC to determine if treatment differences exist in the first-line setting of NSCSL between Caucasians, Hispanics, and African Americans.

In this chapter, I outlined the current treatment standards for lung cancer, the current status around the use of clinical treatment guidelines in lung cancer, and how the

guidelines currently affect outcomes. The theoretical foundations behind healthcare disparities were described using the SCT and the cancer disparities model. This paper contributes to the current body of literature in the area of healthcare disparities in African Americans, Hispanics, and Caucasians.

Literature Search Strategy

The databases that I accessed to search for information on treatment guidelines in lung cancer in racial/ethnic minorities included PubMed, OVID, Medline, Scopus, and Google Scholar. The terms I used to search for the most current peer-reviewed articles include *NSCLC, non-small cell lung cancer, lung cancer, disparities, health care disparities, practice guidelines, insurance, clinical treatment guidelines, Hispanic, race, ethnicity,* and *quality of care. A*rticles were limited to studies in the United States, published in English, with full-text available, that described racial/ethnic treatment patterns and disparities in lung cancer. Articles were delimited to the years 2000 to 2013 in order to capture the most current treatment practices in lung cancer. I also researched the reference lists of identified articles for additional relevant papers. Papers published prior to 2000 were included in order to capture several landmark papers that initially identified healthcare disparities in the United States and to capture background information around the theoretical foundations of healthcare disparities. Articles describing healthcare disparities in advanced lung cancer patients were limited as most research describing disparities in NSCLC were conducted in early stage patients where the comparisons were primarily between African Americans and Caucasians. Limited

data were found describing healthcare disparities in Hispanics with lung cancer and advanced disease.

Theoretical Foundation

The SCT by Bandura (1977) and the cancer disparities model by Freeman and Chu (2005) serve as the framework for this investigation. The SCT originated from the field of psychiatry to describe learning behaviors and was later expanded by Bandura to include human behavior (Pajares, 2007). The SCT describes the influence of three factors on behavior: environmental, behavioral, and personal. The ability to change one's thoughts and behaviors are dependent upon one's perceptions, goals, and willingness to change (Smith, 2000). As such, the SCT has been applied to understand behaviors in stressful situations, problem-solving situations, and outcomes and expectations (Pajares, 2002).

One of the key factors of the SCT is self-efficacy, which was first introduced by Bandura (2005) (1977). Self-efficacy provides for the modeling of behaviors and is obtained by observing the actions of others and from one's own experiences (Pajares, 2002). According to the SCT, individuals have control over their thoughts while behaviors are influenced by one's beliefs and capabilities (Pajares, 2002). The use of social cognitive models has shown that prejudice and stereotyping by healthcare providers is a normal phenomenon. Individuals have the ability to control their actions, beliefs, motivation, and control outcomes based on Bandura's self-efficacy model. This model can be applied to the confidence physicians have in their ability to treat different racial/ethnic patients, follow clinical guidelines, and treat NSCLC (Burgess et al., 2007).

Physicians who do not have positive interactions with racial/ethnic minority patients or are not confident in their ability to treat these patients may not communicate well with them or feel comfortable treating them. This model can be applied to the confidence physicians have in their ability to treat different racial/ethnic patients, follow clinical guidelines, and treat NSCL. As well, the patient may sense that the physician is uncomfortable and in turn may not trust the physicians' judgment or follow the recommended therapy (Dans et al., 2007). There is also evidence that individuals of different races/ethnicities process information differently and this difference affects behaviors and compliance to treatment (Van Ryn et al., 2003). Even if the guidelines have the same effect in all races/ethnicities, physicians may make trade-offs when assessing the risks and benefits of the guidelines (Dans et al., 2007). The physicians' intention to use the guidelines and having the skills to treat the patient according to the guidelines are factors that can influence the use of the clinical guidelines (Michie et al., 2005). Physicians who do not believe in the clinical guidelines are less likely to follow the recommended clinical guidelines. The use of clinical practice guidelines may also be a barrier if the healthcare provider lacks self-efficacy.

Freeman and Chu's (2005) disparity model describes three interrelated causes for the disparities seen in cancer care: (a) low SES; (b) culture; and (c) social injustice. Social injustice is defined as the bias associated with access to treatment, including geographic access, and the perceptions one has of racial/ethnic groups (Freeman & Chu, 2005). Within each of the three causes there are barriers that need to be overcome by the individual, by the healthcare provider, and by the healthcare system. While research has

documented social determinants, insurance status, and access to care as contributors to racial/ethnic disparities, even when these factors are absent differences in care exist (Pienedo, 2011). The ability of the patient to navigate the healthcare system has been shown to contribute to healthcare disparities (Freeman & Chu, 2005). The relationship between the physician and the patient may be contributing to the disparities in care. The effectiveness of communication, cultural awareness, and the patient's level of trust in the physician are factors for a strong physician-patient relationship and are factors that contribute to the physicians' treatment decisions. However, research shows African American patients believe they have better relationships and treatment with their physician if they are of the same race/ethnicity (Saha et al., 2003).

The conceptual framework for research gaps in the treatment of patients, according to race/ethnicity, can be reflected in the quality of care delivered and outcomes (Betancourt & Renfrew, 2011; Meyers, 2007). The difference in quality cancer care ultimately affects the over or under utilization of resources and test, contributes to medical errors, and potentially increased medical costs. While patient preferences may explain some of the differences in care, it only contributes a small part to cancer disparities. Since the behaviors associated with healthcare treatment and outcomes are complex and involve multiple factors no one theory can be used to explain the treatment differences or the disparities seen in the care between racial/ethnic groups (Dressler et al., 2005; Meyers, 2007; Smith, 2000).

Literature Review

Historical and Current Perspective

Over three decades ago the first paper that described the racial differences in cancer survival and mortality was published. In this landmark paper entitled, "Alarming Increase in the Cancer Mortality in the U.S. Black Population (1950-1967)," Henschke et al (1973) described the differences in mortality rates between African Americans and Caucasians for a variety of cancers. At the time, the biggest difference in the increased cancer mortality rate in African Americans was from lung cancer and this difference was thought to be due to environmental factors (Henschke et al, 1973). With the increased number of African Americans who were being diagnosed with cancer and needing medical care, there was a burden on the healthcare system (Henschke et al., 1973). This increase in the diagnosis of cancer and increase in cancer mortality in African Americans led to the initiation of cancer surveillance according to race and ethnicity that today now includes Caucasians, African Americans, and Hispanics among other races/ethnicities in the United States (Brawley, 2006). To assess if there are differences in treatment across ethnicities/races this paper will determine how first line NSCLC treatments compare across racial/ethnic groups, specifically African Americans, Hispanics, and Caucasians and the likelihood of physicians treating according to the clinical practice guidelines.

Prior to 1993 minorities and women were not routinely included in clinical trials and were therefore underrepresented in clinical research (Society for Women's Health Research, 2011). In 1987, the NIH developed a policy stating that minorities and women should be included in clinical trials. To ensure that these two groups were included in the

trials conducted through the NIH, the NIH Revitalization Act was passed in 1993 that mandated minorities and women be included in clinical trials and also required that the number of women enrolled in trials should be large enough to detect differences between the genders (National Institutes of Health, 2001). In addition, gender and race were required to be analyzed to determine if there were differences in treatment (U.S. Department of Health and Human Services, 2005). However, years' later women and minorities are still underrepresented in most clinical trials (Intercultural Cancer Council, 2011).

Racial differences and health disparities between African Americans and Caucasians have been well documented over the years (Brawley, 2006; Freeman & Chu, 2005; Lillie-Blanton et al., 2008; Shugarman et al., 2009; Smedley et al., 2003). According to the NCI, African Americans have the highest cancer incidence and mortality rates of any ethnic group (Howlander et al., 2013). In fact, African American men have 1.4 times higher mortality rates from cancer as compared to Caucasian men (Shavers & Brown, 2002; Ward et al., 2004). African Americans are also twice as likely as Hispanics to die of cancer (Shavers & Brown, 2002). Based on these numbers, African Americans have an overall reduced life expectancy as compared to Caucasians and Hispanics. Research describing cancer disparities has been conducted comparing African Americans to Caucasians with limited research evaluating disparities to other racial/ethnic groups (Saeed, et al., 2012). Although cancer mortality has been decreasing in African Americans, the decrease has not been as great for African Americans as for Caucasians (Shavers & Brown, 2002). And while there is a vast amount of literature to

document the existence of health disparities, there still has not been a significant reduction in the disparities seen between the racial/ethnic groups, indicating that additional research is needed in order to reach the goal of eliminating cancer disparities.

Cancer incidence rates and mortality rates in Hispanics have been tracked since 1992 (ACS, 2009). Hispanics tend to have a lower incidence of cancer overall as compared to Caucasians, except for cervical and uterine cancer, liver cancer, and stomach cancer (ACS, 2009); however, Hispanics have cancer mortality rates similar to Caucasians for lung cancer (Shavers & Brown, 2002). While the trends in cancer incidence and mortality in Hispanics have been followed for a much shorter period of time, studies have documented that racial disparities in treatment exists, although Hispanics are not studied as frequently as African Americans (Agency for Healthcare Research and Quality, 2012; Saeed et al., 2012; Betancourt & Renfrew, 2011; Smedley et al., 2003). Therefore, this paper evaluated how NSCLC treatment paradigms compare across racial/ethnic groups including African Americans, Hispanics, and Caucasians and if these groups differ in the treatment received for advanced stage IIIB or stage IV first-line metastatic NSCLC and if the patients are treated according to the current clinical practice guidelines.

Non- Small Cell Lung Cancer and Treatment

NSCLC and small cell lung cancer (SCLC) are the two major types of lung cancer. NSCLC is the more common and represents 85% of lung cancer cases and will be the focus of this paper. There are several major cell histology that are used to describe

NSCLC: adenocarcinoma, squamous cell carcinoma, and large cell carcinoma representing 40%, 30%, and 15% of histology respectively (ACS, 2013).

Because there is not a routine screening test for lung cancer, approximately 75% of patients are diagnosed in the advanced stages of the disease when the prognosis is poor and is rarely curable (ALA, 2010; Hardy et al., 2009). The treatment of NSCLC depends on the stage of the disease when diagnosed, on the patient's performance status, and on a number of other factors. Stage IV metastatic NSCLC is a cancer that has spread outside of the lungs to other parts of the body making the disease incurable (ACS, 2013). Patients with advanced stage metastatic NSCLC are usually treated with a platinum-based doublet; the only recommended exception is a triplet combination with platinum based chemotherapy with bevacizumab for adenocarcinoma histology in appropriate patients. The FDA approved agents for treating advanced stage NSCLC are cisplatin, carboplatin, paclitaxel, docetaxel, gemcitabine, pemetrexed, erlotinib, and bevacizumab (NCCN, 2013). Other drugs are available to treat NSCLC according to the National Comprehensive Cancer Network guidelines, however they are not FDA approved. Radiation therapy in combination with a platinum agent is recommended in stage IIIB NSCLC. Radiation alone may also be administered to patients with metastatic disease as palliation (NCCN, 2013). As targeted therapies are approved for NSCLC, the treatments become more expensive and the treatment becomes more complex. As these newer and more expensive therapies are incorporated into the clinical practice guidelines for use in a broader patient population, do all patients receive these agents as recommended? This study evaluated the real-world treatment of patients with advanced/metastatic NSCLC to

determine if they were treated according to the recommended NCCN clinical practice guidelines.

Clinical Practice Guidelines

The IOM defines clinical practice guidelines as "systematically developed statements to assist practitioners and patient decisions about appropriate health care for specific clinical circumstances (Smedley, et al, 2003)."

Clinical practice guidelines define the "gold standard" of treatment or best practices and provide health care professionals with the tools to provide high quality care based on the most current information and research from clinical trials. Clinical trials provide the foundation for developing clinical practice guidelines in oncology; however, there are few minorities that participate in clinical trials. Only 5% of African Americans and 1% of Hispanics participate in clinical trials today (Coakley et al., 2012). Many African Americans still recall the Tuskegee experiment from the 1970s and have distrust for clinical trials (Gamble, 1997). Clinical practice guidelines are an important part of cancer care as they can influence the physician's decision for appropriate treatment and care, provide the physician with evidence gained from clinical research to reduce treatment variations between patients, potentially improve treatment outcomes, reduce morbidity and mortality, and can improve the quality of care (Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999). Disparity develops when clinical practice guidelines are followed for one patient population but not another population. Clinical research conducted at Veteran Affairs hospitals demonstrated that when cancer patients are treated with similar therapy the outcomes are similar across patients regardless of socioeconomic

status (Shavers & Brown, 2002). However, there is disagreement with the finding from the VA hospital findings as noted by Samuel, Landrum, McNeil, Bozeman, Williams, and Keating (2014). Although patients may have the same clinical problem, patients may or may not receive the same treatment depending upon the location of the facility where the treatment is administered, the physician's awareness of the clinical guidelines, and the physician's clinical experience (McKinlay, Link, Freund, Marceau et al., 2007; Samuel et al., 2014). McKinley et al. (2007) also noted that race and socioeconomic status had no effect on whether clinical practice guidelines were followed. According to the NCCN guidelines, the current treatment for stage IV NSCLC is treatment with chemotherapy, radiation therapy, or a targeted agent such as bevacizumab (NCCN, 2013). Treatment will depend upon the histology of the tumor, the location of the tumor, the number of metastases, and the patient's overall medical condition (NCCN, 2013). While stage IV lung cancer is not curable, treatment can improve the quality of life and extend survival for some patients.

Clinical practice guidelines, when followed, have the potential to change healthcare providers' behaviors, to improve the quality of care patients receive, and enhance the outcomes from treatment (Smith, 2000; Woolf et al., 1999). The adoption of clinical practice guidelines tends to be dependent upon the quality and strength of the research to support the guideline, upon the physician attitude and type of practice, and upon the patient; however, an understanding of the influence of clinical practice guidelines on healthcare differences and disparities in NSCLC is limited (Graham et al., 2011; Visser, Ma, Zak, Poulsides, Norton, & Rhodes, 2012).

Compliance to clinical practice guidelines varies (Hakkennes & Dodd, 2007). Factors that influence clinical practice guideline adherence include physician age and years of practice experience (McKinlay, 2007). Grol and Grimshaw (2003) and Hakkennes and Dodd (2007) showed that up to 40% of patients are not treated according to practice guidelines and receive unnecessary treatment. Foy et al. (2002) showed that when clinical practice guidelines are implemented and used there was an increase in physician compliance to following the guidelines. There is evidence to suggest that 57% of patients with early stage NSCLC are treated with surgery then chemotherapy as recommended by the guidelines (Cancer Quality Council, 2013). Bach (2005) suggests that African Americans receive care at facilities of lower quality and as such clinical practice guideline may not be followed. When practice guidelines were followed, acceptance varied by the type of cancer (Harlan et al., 2005). Harlan et al. (2005), Woolf et al. (1999), and McKinlay (2007) also suggest that following treatment guidelines can be used as a benchmark to improve the quality of care for patients. Since clinical practice guidelines in oncology are generally updated yearly or as needed, following clinical guidelines provide healthcare providers with the ability to stay current with research progress and could help bridge treatment gaps (Li et al., 2011). In addition, when patients are aware of the clinical practice guidelines they have the ability to make more informed decisions about their care and help improve quality of care. Providing consistent care could reduce mortality and morbidity in cancer patients (Austin et al., 2010; Evensen et al., 2010; Harlan et al, 2005; Li et al., 2011; Meyers, 2007).

The Guidelines for NSCLC

Clinical practice guidelines are used in a variety of healthcare environments from the physician, the nurse, to insurance payers for the objective of standardizing and improving the quality of care. The guidelines provide the diagnosis, treatment, and palliative care for a variety of cancers, including NSCLC. Clinical practice guidelines for NSCLC provide healthcare providers with the currently accepted treatments for patients based on the evidence from clinical trials. The recommended guidelines for advanced stage IIIB or stage IV NSCLC were used as the basis for determining outcomes in this study. The physicians' treatment plan will depend upon the histology of the tumor, the location of the tumor, the number of metastases, and the patient's overall medical condition (NCCN, 2013).

For stage IIIB NSCLC the recommended treatment is concurrent therapy of combined platinum-based chemotherapy with once daily radiation in patients with minimal weight loss (Jett et al, 2007). The effect of radiation or chemotherapy alone is not as effective as the combination. Treatment should be administered as soon as possible after diagnosis.

For stage IV NSCLC, the patient usually has metastatic disease. Approximately one third of patients will be diagnosed with a single brain metastasis where surgery followed by radiation to the brain is recommended (ACS, 2014). Stage IV disease is present if there is the presence of a malignant pleural effusion. According to the NCCN practice guidelines, the current treatment for stage IV NSCLC is chemotherapy, radiation, or a targeted agent such as bevacizumab (NCCN, 2013). The guidelines recommend

treatment for 4 to 6 cycles or until disease progression. The treatment of NSCLC depends upon the patients' performance status, which is a known prognostic factor for improved survival (Azzoli, Giaccone, & Temin, 2010). While stage IV lung cancer it not curable, treatment can improve the quality of life and extend survival for some patients.

Clinical Trials and Quality of Care

Clinical trials are the gold standard for providing evidence that defines the standard of care in cancer. Oncology clinical practice guidelines are developed for use in the decision- making process of patient care using the evidence based on the results of large randomized controlled clinical trials and are used for improving the quality of patient care. Accurate and timely reporting of clinical trial results is essential for determining the validity and credibility of the data and for establishing and maintaining quality care. However, there is evidence that the reporting of clinical trial results in oncology is inadequate and inconsistent (Dancey, 2010; Schultz et al., 2010). The Consolidated Standards of Reporting Trials (CONSORT) guidelines were established for reporting the essential elements to include for all clinical trial reporting (Maher et al., 2010). These elements include, for example, the name of the drug, the trial design details, the administration of the drug, the dosing, adverse events, and supportive care measures (Duff et al., 2010). Research revealed that 11% of oncology clinical trials reported in top peer-reviewed journals included all the CONSORT elements for clinical trial reporting and less than half of the articles reviewed contained data about dose modifications for renal insufficiency or patient monitoring (Duff et al., 2010). However, CONSORT does not include some of the complexities of administering chemotherapeutic

agents. Clinical practice guidelines do provide the clinician with the most current oncology treatments and care and provide information for oncology drug reimbursement; however, there needs to be transparency and consistency in reporting the results. The ability to provide consistent treatment and quality care in patients may help reduce disparities.

Disparities

A large amount of literature exists that reveals there are differences in healthcare treatment and in outcomes between Caucasians and African Americans based on socioeconomic status (SES). Even when SES is controlled, disparities in health status still remain (Penner, 2007). While there are data available to describe the differences in treatment and care for patients with cancer, the literature emphasizes the earlier stages of lung cancer disparities primarily and in African Americans compared to Caucasians (Yin, Morris, Allen, Cress, Bates, & Liu, 2010). There are limited data evaluating the differences in healthcare among patients with advanced stage NSCLC and there is limited data in patients who are Hispanic.

Potosky, Saxman, Wallace & Lynch (2004) evaluated the initial treatment of approximately 900 NSCLC patients across all stages of disease and found that overall 52% of patients received the recommended treatment according to stage of disease as determined by the ASCO practice guidelines. When treatment was stratified by race/ethnicity, African Americans and Hispanics received recommended therapy less frequently than Caucasians, 44%, 46%, and 53% respectively (Potosky et al., 2004). When patients were evaluated by stage of disease alone, patients with stage IV advanced

NSCLC received recommended initial treatment 41% of the time. Potosky and colleagues suggested there might be gaps in quality of care for patients with NSCLC.

In another study Shugarman and colleagues (2009) utilized the SEER database to evaluate treatment differences between race/ethnic groups with advanced NSCLC and found that half of the time appropriate and timely treatment was not given to African Americans with stage IV disease as compared to Caucasians (Shugarman et al. 2009). There were also differences in the timeliness of receiving therapy between race and gender and stage of disease at the time of diagnosis. Overall, patients with stage III NSCLC were more likely to receive timely treatment (Shugarman et al., 2009).

Previous research suggests there may be differences in treatment outcomes between patients. From 1974-2001, the Southwest Oncology Group evaluated over 19,400 cancer patients in 35 clinical trials, which included nearly 2700 patients with lung cancer to determine if racial disparities existed in overall survival (Albain et al, 2009). The study included an average of 11% African Americans. Because patients were enrolled in clinical trials, there was consistency in the treatment received and in follow-up for all patients. While there were differences in overall survival reported between African Americans and Caucasians for certain cancers, there was no statistical association between race and overall survival for patients with NSCLC (Albain, et al, 2009). Factors such as gender, age, weight loss, performance status at diagnosis, and stage of disease have been found to be associated with outcomes in patients with NSCLC (Blackstock et al., 2002). In a study conducted between 1989 to 1999 by the Cancer and Leukemia Group B (CALGB) the effect of race/ethnicity on survival was retrospectively evaluated

based on 5 phase II and phase III clinical trials from various cancers (Blackstock et al., 2002). A total of 458 Caucasian and 46 African American patients with advanced stage IIIB or IV NSCLC were evaluated for survival. Most patients completed a questionnaire providing their educational level, income, medical insurance coverage, and employment status prior to starting therapy. African American patients were more likely to be unmarried, unemployed, lack insurance, and have a lower socioeconomic status, lower performance status and weight loss at diagnosis. The results revealed that the estimated one-year survival for Caucasians was 30% versus 22% for African Americans. When adjustments were made for weight loss and performance status, African Americans had greater weight loss than Caucasians, but this did not affect survival. These authors concluded that while race/ethnicity did not affect survival, weight loss and performance status prior to treatment had a greater impact on treat outcomes. In a Veterans Affairs Cooperative Study, no statistical difference in response rate or performance status was noted between African Americans and Caucasians with NSCLC treated with chemotherapy (Shavers & Brown, 2002). Both African Americans and Caucasians experienced a similar 5-year overall survival rate; however, African Americans were 30% less likely to receive palliative care despite having equal insurance coverage (Shavers & Brown, 2002). Advanced age has been found to be a predictor for physicians not using the clinical practice guidelines to determine treatment (Wang et al., 2012).

Studies in early stage NSCLC evaluating disparities found that only patients with stage I, II or III NSCLC received appropriate therapy for stage of disease and that treatment was related to the age and race of the patient (Potosky et al., 2004). In a report

by Bach and colleagues (2005b), African Americans with early stage NSCLC were less likely to have curative surgery than Caucasian patients despite having similar insurance and economic level. A study from the University of Texas confirmed the results from Bach and others and found that African Americans received therapy according to clinical practice guidelines for early stage cancer 37% less often than Caucasians (Hede, 2010).

Healthcare disparity in NSCLC among Hispanics is not well understood. There are few studies in the literature that describe the disparities experienced by Hispanics in the treatment of lung cancer, and when Hispanics are included in the studies they are usually underrepresented (Saeed, 2012). Two studies, one using the SEER database and the other study using the California Cancer Registry evaluated survival outcomes in Hispanics with NSCLC (Patel et al., 2013; Saeed et al., 2012). Foreign-born Hispanics were compared to U.S. born Hispanics. Patients were evaluated based on several confounders such as, age, gender, stage of disease, SES, and the neighborhood where they lived. The results from these two studies demonstrated that foreign-born patients with NSCLC had a 13% to 15% (HR, 0.85- 0.87) lower mortality rate than patients born in the United States (Patel et al., 2013; Saeed et al., 2012). When patients were evaluated by tumor histology, Hispanic patients were found to have either adenocarcinomas or bronchioalveolar (BAC) tumors. BAC tumors have a more favorable profile and a lower mortality rate (Patel et al., 2013). Lung cancer patients who were foreign-born were 40% more likely to be diagnosed at a more advanced stage of disease, at an earlier age, and less likely to receive treatment for their cancer (Patel et al., 2013; Saeed et al., 2012). U.S. born Hispanics had a lung cancer survival rate equivalent to non-Hispanic White

lung cancer patients (HR, 1.00). While foreign-born Hispanics have a lower SES than U.S. born Hispanics, they still maintained a survival advantage over U.S. born Hispanics. One possible reason for the differences in survival between foreign born and U.S. born Hispanics could be the acculturation of Hispanics born in the United States or that foreign-born Hispanics return to their country of origin when they become too sick; but the survival patterns did not validate this trend (Patel et al., 2013). A meta-analysis of 58 studies from 1990 to 2010 showed that Hispanics with cancer have a survival advantage that is equivalent to non-Hispanic Whites (Ruiz, Stefan, & Smith 2012).

Insurance Status

Insurance status has been shown to be a predictor for determining access to cancer care and receiving appropriate care (Shugarman et al., 2009; Ward et al., 2008). However, the evidence is mixed as there are few studies evaluating the association of insurance status and cancer treatment outcomes and even fewer studies specifically in lung cancer. During the past decade research has shown that patients who are underinsured or uninsured had worse treatment outcomes than patients with private insurance (Harlan et al., 2005; Niu et al., 2013). Harlan evaluated the association of insurance and cancer outcomes in 11 different cancers and found that patients without insurance or patients with private insurance had better outcomes than patients with either Medicare or Medicaid. An article recently published by Nui and colleagues (2013) found that between 1995-2004, cancer patients in New Jersey with Medicaid or who were uninsured had a higher risk of death than patients with private insurance**.** These findings concur with a number of other studies previously conducted (Blackstock et al., 2002;

McDavid, Tucker, Slogett, & Coleman, 2003; Ward et al., 2008). When Harlan et al. (2005) evaluated a variety of cancers for treatment according to the clinical guidelines and according to insurance status; they found that the type of insurance patients had influenced treatment according to the recommended guidelines. Patients with private insurance were more likely to receive cancer treatment according to the guidelines regardless of race/ethnicity than patients on Medicaid or Medicare (Harlan et al., 2005). Patients with Medicaid insurance only were the least likely to receive therapy according to the guidelines while patients with no insurance or private insurance were most likely to receive treatment according to the clinical treatment guidelines, 70%, and 65% respectively. Blackstock et al. (2006) and ascribed that when insurance status, economic status, stage of disease, and age are equal, treatment for early stage NSCLC with chemotherapy and/or surgery outcomes are similar.

To answer the question of which factors have a greater influence on patient's healthcare, Trevedi et al. (2006) investigated whether the quality of the insurance plan or the race/ethnicity of the patient affected health outcomes more. Trevedi et al. examined health records from over 400,000 patients on over 150 Medicare plan between 2002-2004 for quality and performance and revealed that neither the insurance plan nor the quality or performance contributed to disparities. Despite having the same insurance plan, significant disparities were found between African American and Caucasian health outcomes (Trevedi et al., 2006). Halpern et al (2008) also found that insurance status influenced cancer treatment and that individuals over 65 years of age with Medicare do not receive equal treatment, even though the stage of cancer at the time of diagnosis was

similar across insurance types. In a second study, Halpern and Holden (2012) found that insurance status also influenced the timeliness of cancer treatment; African Americans and Hispanics were found to experience treatment delays more often than Caucasians. Patients having both Medicaid and Medicare coverage still experienced delays in treatment. When universal insurance coverage is available, disparities still exist in cancer treatment (Li et al., 2011). Yorio et al. (2012) indicated that when patients are treated at VA Hospital or an NCI designated cancer center differences in overall survival appear to disappear. Differences in insurance status may contribute to cancer outcomes; however, additional research is needed in this area to overcome the disparities in care experienced by patients with lung cancer (Halpern & Holden, 2012).

A robust example for comparison is the medical system for the U.S. military, which provides unlimited and equal access to healthcare and can provide an opportunity to evaluate healthcare disparities under equal conditions. In an effort to evaluate if there is disparity in lung cancer survival between men and women and between race/ethnicity of military personnel, Mulligan et al (2006) conducted a retrospective chart review of 907 NSCLC patients treated at Walter Reed Medical Center from 1990 to 2000. Patient survival was analyzed by age, gender, race/ethnicity, family history of cancer, smoking history, stage of disease, and lung cancer histology. The overall survival of NSCLC patients treated at Walter Reed Army Medical Center were compared to the overall survival of NSCLC patients in the SEER database for 2000. The overall 5-year survival at Walter Reed was higher than the 5-year national average for survival in the SEER database, 22.4% versus 15.2 % respectively (Mulligan et al., 2006). The 5-year survival

for African Americans versus Caucasians was essentially equal at 22.3% versus 22.7%. Even when survival was evaluated by gender, survival was higher for the Walter Reed Army Medical Center patients compared to the national average in SEER. Gender was the only factor that affected 5-year overall survival with females having a longer survival than males, 28.9% versus 19.4% (Mulligan et al, 2006). Mulligan and colleagues suggest that when there is equal access to healthcare, health outcomes are equal implicating a lack of access to medical care as a cause for racial/ethnic disparities. A larger study conducted by the Department of Defense using their central tumor registry database confirmed the results of Mulligan and colleagues indicating that NSCLC survival is higher in a military facility than the general population and that equal access to care may eliminate health disparities (Zheng et al., 2012).

Which factors are contributing to lung cancer disparities and how these factors affect each other remain unclear. Lung cancer treatment appears to vary by place of treatment, utilization of health care services, institutional policies, race/ethnicity, gender, and socioeconomic status. Having standards of care established and guidelines in place may help to eliminate some of the differences in treating NSCLC and reduce healthcare disparities.

Socioeconomic Status, Race, and Environmental Factors

There are considerable data in the literature documenting that race and socioeconomic status affect mortality; however, there is less data on how these factors impact cancer mortality in patients with lung cancer. Albano et al. (2007) sought to determine if there was a relationship between education, race/ethnicity, and mortality in

cancer patients, including lung cancer, by using U.S. census data and death certificates from African American/Black and Caucasian cancer patients in 47 states. Overall, the death rate for African Americans was higher than for Caucasians at comparable educational level. Albano and colleagues contribute the difference in mortality to the differences in overall socioeconomic status between the two groups (Albano et al., 2007). When lung cancer mortality was evaluated, the difference between African American and Caucasian patients by educational attainment was greater than for other cancers that were evaluated. Patients with an educational level of 0 to 8 years had a mortality rate that was nine times higher than patients with educational attainment of 17 or more years and was higher in African American men and women as compared to Caucasian men and women (Albano et al., 2007). Albano and colleagues (2007) found a stronger association between educational level and cancer mortality than in previous studies.

There are considerable data to show that the geographic area one lives in influences the quality of health care and mortality (Myers, 2007). Research suggests in areas of low socioeconomic status that there may be fewer resources available, that the healthcare providers maybe less educated and that patients may not receive timely and appropriate therapy (Goulart et al., 2013). Referrals to medical specialists have also been shown to influence cancer care. Patients in a lower socioeconomic group are also less likely to be referred to an oncologist or to receive recommended therapy as compared to patients in a higher socioeconomic group (Goulart et al., 2013; Freeman & Chu, 2005). Life expectancy, the geographic location, the number of healthcare providers in an area, and treatment variation play a role in healthcare treatment and can contribute to the

disparities experienced by minorities (Meyers 2007; Watson, 2001).

Cognitive Factors

A healthcare providers' perception can affect the care patients receive. According to the SCT, physicians contribute to health disparities through stereotyping and bias that reflects in the quality of care (Smedley, 2003; Burgess et al., 2004). The SCT theory suggests that the healthcare providers understanding of the information provided by the patient and how the information obtained is interpreted may contribute to racial/ethnic differences in care and outcomes (Meyers, 2007; Burgess et al., 2004). Consciously or unconsciously healthcare providers express biases and categorize individuals according to characteristics, social categories, and stereotypes (Burgess et al., 2004). Healthcare providers also make judgments about how a patient will follow through with treatments (Burgess et al., 2010). Several studies revealed that Caucasian healthcare providers perceive African Americans as having less family support and as being less compliant to treatments long-term (Bogart et al., 2004; van Ryn et al., 2003).

When physicians process large amounts of complex information to make clinical decisions, they tend to act on what they have already learned and already know, especially when there may be insufficient information available about the best treatment to provide to a patient thereby causing the potential for errors in diagnosis and treatment (Freeman & Chu, 2005; Burgess et al, 2004). These decisions in turn also have the ability to affect the communication between the clinician and the patient and adherence to therapy (Burgess et al., 2010; Smith, 2000).

Behavioral Factors

According to the SCT, an individual's behavior is influenced by the behaviors and thoughts of others' around them (Pajares, 2002). Studies in SCT have examined healthcare provider behaviors to understand how race/ethnicity affects treatment. Physician treatment patterns are influenced by their medical training, background, by the variety of medical experts whom they interact, by their mentors, by medical ethics, and by other colleagues (Smith, 2000). In addition, stereotypes by healthcare providers have been shown to influence the patient. If a patient feels they are being discriminated against or the physician exhibits anxiety, the patient may not communicate openly with the physician, may not share information about their illness, and may even be less complaint to treatments (Burgess et al., 2010; Smith, 2000). Blair et al. (2013) conducted telephone interviews with patients to determine the perception and satisfaction with their physician. African Americans consistently reported more bias on the part of the physician and more dissatisfaction with care. Hispanics/Latinos did not report bias but consistently rated the physician lower on knowledge of their health concerns, medical history, and interpersonal skills (Blair et al., 2013). Providing continuity of care through the use of clinical practice guidelines may improve the quality of care patients receive (Penner et al., 2007).

Tumor Boards

Tumor boards serve an important role in cancer programs and there are data reported that they might improve cancer care (Scher et al., 2011). Tumor boards bring physicians and other healthcare providers together from medical oncology, radiation

oncology, pathology, radiology, surgery, and other allied health specialties to discuss the management and care of the newly diagnosed patient. Physicians from their respective discipline present the current treatment strategies appropriate for the patients' cancer and discuss the current clinical trial data to help guide the treatment course for the patient. All NCI designated cancer programs have either general or tumor specific tumor boards as required by the American College of Surgeons Commission on Cancer Program Accreditation but their effect on cancer care has not been well studied. (Keating et al, 2012). Some controversy exists as for the value of tumor boards improving quality care based on the physician recommendations provided from the tumor board. The Department of Health Policy at Harvard Medical School evaluated the association between the recommendations, quality of care and outcomes of patients in 138 Veterans Administration (VA) Hospitals and physicians attending tumor boards and found there was little to no association between physicians attending tumors boards, between the recommended treatment patients received and outcomes (Keating et al., 2012). Other researchers have noted that tumor boards may not influence physician treatment and outcomes in large institutions, but may be more effective in small cancer centers (Blayney, 2012). However, Scher (2011) found that over 80% of physicians attended tumor boards when they are offered and that tumor boards provide a way for physicians to discuss the treatment of difficult patient cases as a way to improve the quality of care (Scher, 2011). Physicians with high volume practices, treating 25 or more new patients per month were more likely to attend tumor boards (Scher, 2011). Additional research is still needed to determine the characteristics of the physicians attending tumor boards and

the influence of tumor boards on physician treatment patterns and clinical guideline adherence (Blaney, 2013; Keating et al., 2013; Scher, 2011).

Addressing treatment differences and disparities in lung cancer is complex and involves multiple factors that cannot be defined by one theory. Preliminary research in NSCLC healthcare disparities is mixed and this suggests that further research is needed. If practice guidelines are available and followed to influence clinical decision making, there may be fewer disparities seen between races/ethnicities.

While most of the research regarding disparities in lung cancer is focused in the earlier stages of the disease and compares African Americans and Caucasians, this research study will address how the current treatment guidelines available for NSCLC guidelines are used in a population-based patient population that includes Hispanics. Hispanics continue to rapidly increase in the United States yet represent a smaller percentage of the patients in the SEER database. To gain a better understanding of the treatment paradigms' within this ethnic group they should be included in treatment and disparities research. This research study will include an evaluation of Hispanic patients with advanced metastatic NSCLC since there is little research about the treatment paradigms of these patients.

This research study will build on what is currently known about treating advanced stage NSCLC in a diverse population of Hispanics, African Americans, and Caucasians. Specific chemotherapy and targeted therapies will be evaluated for their use in NSCLC and if they are used according to the current clinical practice guidelines within each of the racial/ethnic groups.

Summary and Conclusions

This chapter describes some of the multiple factors involved in healthcare disparities. Although research has been conducted on cancer disparities, the causes for these disparities still are not well understood, particularly among Hispanics. The SCT and Bandura's self–efficacy model suggest that physicians unconsciously contribute to health disparities. Previous research on disparities in lung cancer has been conducted on the comparisons between African Americans, who have the greatest lung cancer burden, to Caucasians in the earlier stages of the disease. The research also revealed that despite equal socioeconomic status and equal insurance coverage differences in cancer care and outcomes remain. There is limited data studying the treatment paradigms and differences in treatment and care among Hispanics and African Americans as compared to Caucasians in the later stages of NSCLC. This study will attempt to fill the gap and focus on evaluating the use of lung cancer clinical treatment guidelines in patients with advanced/metastatic NSCLC between Hispanics, African Americans, and Caucasians. This study has considered the limitations and will therefore evaluate patients for treatment patterns and to determine if there is a relationship between race/ethnicity and lung cancer treatment according to the NCCN clinical practice guidelines.

Since healthcare professional's training and behaviors have been shown to contribute to the disparities, having clinical practice guidelines available to physicians treating patients is a first step in an attempt to reduce racial and ethnic differences in the treatment of disease. Having an understanding of the extent to which NSCLC clinical practice guidelines are consistently used across racial/ethnic groups, this research study

may help to bring us closer to reducing the cancer burden in the United States and improving care for all patients.

Chapter 2 provided the background on healthcare disparities and the literature as it related to the research questions and hypotheses, and the objective of the study. Chapter 3 outlines the quantitative research methodology that was used for this study. A description of the study hypotheses based on the research questions will be explained. A description of the retrospective research design, the dependent, and independent study variables, a description of the NCI database that was used, the techniques for the data collection, and data analysis are included. The determination of sample size and a description of the patients are explained. The relationship between race/ethnicity for initial advanced lung cancer treatment and the use of clinical treatment guidelines are determined.

Chapter 3: Research Method

Introduction

Lung cancer is a major killer in the United States with approximately 155,000 patients dying from the disease each year (ACS, 2014). It is primarily a disease of the elderly with over 60% of patients diagnosed with lung cancer over 65 years of age (Foster, Salinas, Mansell, Williamson, & Casebeer, 2010). With the complexities of treating lung cancer and the new diagnostic technologies being developed, clinical treatment guidelines constantly need to be updated to include the newest research discoveries, physicians need to be aware of the updates and be able to incorporate the guidelines to their clinical treatment decisions.

In this chapter, I provide an overview of the research methodology used in this study to test the hypotheses and answer the research questions around the first-line treatment for NSCLC in three racial and ethnic groups according to the NCCN treatment guidelines. I also describe the research hypothesis and questions. In addition, a description of the study population, the procedures for selecting the sample population and determining the sample size, a description of the inclusion and exclusion criteria, an explanation of the study variables, and details of the statistical plan are provided. This chapter also includes a discussion of issues pertaining to reliability and validity of the study and the data collected from the SEER/Medicare database. The chapter concludes with the ethical considerations for this research.

Purpose of the Study

The purpose of this retrospective quantitative study was to evaluate the differences among Caucasian, Hispanic, and African Americans with NSCLC within strata as defined by stage and histology and the receipt chemotherapy for the first-line treatment of advanced/metastatic NSCLC treatment according to clinical practice guidelines while controlling for age and gender. For this study, patients were stratified into four groups: (a) stage IIIB disease and adenocarcinoma; (b) stage IIIB and squamous cell carcinoma; (c) stage IV disease and adenocarcinoma; and (d) stage IV disease and squamous cell carcinoma.

Research Design and Rationale

Research Question

To understand the association between race/ethnicity and the receipt of first-line treatment of advanced/metastatic NSCLC according to the recommended NCCN clinical practice guidelines for stage and histology strata, the following research question was asked: What is the likelihood of Caucasian, African American, and Hispanic patients with NSCLC being equally treated according to the NCCN practice guidelines within stage and histology strata after controlling for age and gender?

Evidence suggests that there may be an association between race/ethnicity and the receipt of first-line therapy for advanced/metastatic NSCLC and physicians following clinical practice guidelines. Therefore, the following hypotheses were evaluated.

Null and Alternative Hypotheses

1. H_o: Caucasian and African American patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age and gender, and geographic location.

H_1: Caucasian and African American patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology after controlling for age and gender, and geographic location.

2. H_o2: Caucasian and Hispanic patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location

H_12: Caucasian and Hispanic patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location

3. H_o3: Hispanic and African American patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender and geographic location

H_13: Hispanic and African American patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location

Dependent and Independent Variables

The dependent variable for this study was receipt of first-line treatment with chemotherapy according to NCCN treatment guidelines (i.e., receiving either taxane plus

platinum, gemcitabine plus platinum, pemetrexed plus platinum, or the triple combination of bevacizumab plus platinum-based therapy for stage IV NSCLC and platinum plus etoposide alone or concurrent radiation and platinum plus etoposide for stage IIIB NSCLC based on histology). The predictor variables were age (65-70, 71-75, 76-80, 81-85, and 85 and older), gender (male, female), and race/ethnicity, which were recorded as Caucasian, African American, or Hispanic (see Table 1). Patients were stratified by stage of disease and histology into four groups: stage IIIB disease with either adenocarcinoma or squamous cell carcinoma and stage IV disease with either adenocarcinoma or squamous cell carcinoma. Stage IIIB NSCLC was defined as patients with disease that has spread to the lymph nodes near the collarbone or to the nodes on the opposite side to the tumor, patients with a pleural effusion, or with disease that has spread to other areas within the chest, such as the esophagus or trachea. Patients with stage IV NSCLC have disease that has spread outside of the chest wall to other parts of the body such as the bone, liver, or brain, or has spread to other distant lymph nodes. Recommended and appropriate therapy for stage IIIB NSCLC is radiation plus chemotherapy or chemotherapy alone. Recommended therapy for stage IV NSCLC is a doublet combination of chemotherapy (NCCN, 2014). There are no recommendations for the administration of a specific chemotherapy with the exception of pemetrexed, which is indicated for adenocarcinoma histology and gemcitabine for squamous cell histology (NCCN, 2014). Although the approach to treating older cancer patients is unclear, age has been found to be an influencing factor in treating patients with advanced/metastatic NSCLC. The benefits of treatment outweigh the risk, yet many cancer patients are

undertreated (Foster et al., 2010). Foster et al. reported that patients over the age of 78 were less likely to receive standard chemotherapy than patients younger than 60 years of age, despite being in relatively good health. While there is not a specified time period in which treatment should be initiated, starting therapy as soon as possible after diagnosis, usually within a month, has been shown to improve outcomes (Yorio et al., 2009). Initiating therapy within 45 days of diagnosis was used as the timeframe for this study.

Table 1

Description of the Dependent and Independent Variables

Variable	Dependent variables	Independent variables	Characterization
Treatment according to NCCN guidelines 1. Taxane/platinum 2. Taxane/platinum/ Bevacizumab 3. Pemetrexed/ platinum 4. Gemcitabine/ platinum 5. Radiation 6. Radiation/ chemotherapy	X		Nominal (yes or no)
Stage of disease		X	Stratification variable
Stage IIIB			Categorical
Stage IV			
Age, yrs		X	Interval/grouped
Gender		X	Nominal
Male			
Female			
Histology			Stratification variable
Adenocarcinoma		X	Categorical
Squamous cell			
Race			
Caucasian		X	Referent group
Hispanic			Dummy Variable
African American			Dummy Variable

Adherence to NCCN Clinical Practice Guidelines

Adherence to the NCCN clinical practice guidelines for this study was based on the patient stage of disease and tumor histology. Most patients with stage IIIB disease are not eligible for surgery; therefore, treatment is based on the patient's extent of disease, performance status, and co-morbidities. Because performance status is not captured in the SEER-Medicare database, patient histology and extent of disease based on stage of lung cancer was used to determine appropriate treatment. The NCCN clinical treatment guidelines recommend concurrent radiation, platinum, and etoposide or radiation with paclitaxel and platinum chemotherapy for patients with stage IIIB NSCLC (Figure 1). The recommended dose of radiation is 60-70 Gy over 6-7 weeks. Radiation alone can be used as palliation to treat pulmonary symptoms such as pain or shortness of breath (NCCN, 2013). Based on the clinical data nonplatinum-based chemotherapy does not provide a treatment benefit over platinum based therapy (Lwin, Riess, & Gandara, 2013; NCI, 2014).

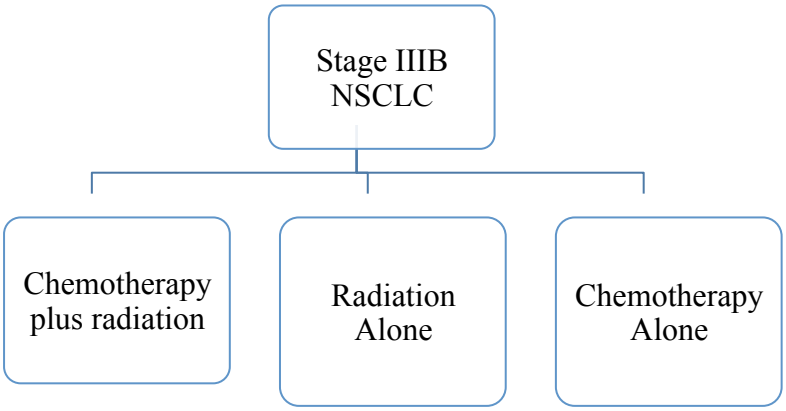

Figure 2. Treatment Algorithm for Stage IIIB NSCLC based on the NCCN NSCLC Guidelines.

Patients with stage IV NSCLC have metastatic disease at the time of diagnosis. The goal of treatment is to extend survival and palliate symptoms from the disease (NCCN, 2014). Performance status is one of the most important prognostic factors for outcomes; however, performance status is not currently captured in the SEER-Medicare database. Therefore, treatment according to the recommended treatment guidelines was determined by histology. The NCCN treatment guidelines recommend a platinum-based chemotherapy doublet as first-line treatment of stage IV NSCLC; however, there are no definitive combinations recommended (NCCN, 2014).

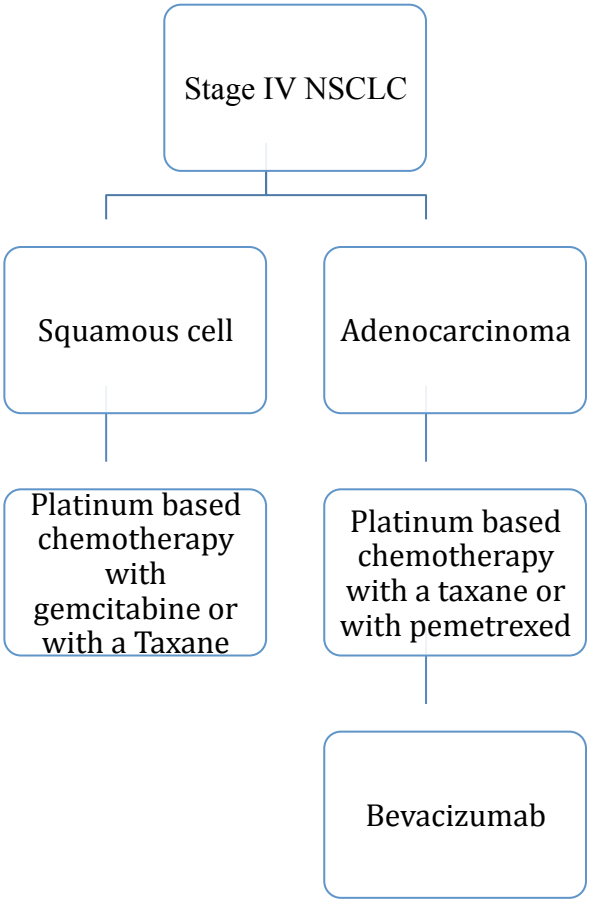

Figure 3. Treatment Algorithm for Stage IV NSCLC based on the NCCN NSCLC Guidelines.

Treatment for stage IV NSCLC is recommended for four cycles and if the patient is responding may receive two additional cycles, for not more than a total of six cycles of therapy in the first-line setting. A triple combination of paclitaxel, carboplatin, and bevacizumab is recommended for patients with nonsquamous histology (adenocarcinoma) if the patient does not have a centrally located lung tumor. However, other triplet combinations are not recommended because of the added toxicity and have not been found to offer a survival advantage over the doublet regimens (NCCN, 2014). The combination of pemetrexed plus platinum chemotherapy is recommended for

patients with adenocarcinoma, whereas gemcitabine or a taxane plus platinum chemotherapy is recommended for patients with squamous histology (Azzoli et al, 2011). Radiation is recommended for patients with stage IV NSCLC for palliation of symptoms from the disease, such as bone metastases or for brain metastases (NCCN, 2014). The NCCN clinical practice guidelines for stage IIIB and IV NSCLC have change overtime. The two differences from 1998 to 2014 are that histology matters. Patients are now treated differently based on the histology of the tumor and the duration of treatment for stage IV NSCLC was shortened in 2003 from a maximum of eight cycles of therapy to no more than six cycles of therapy. If the patient is not responding to therapy it should be stopped at four cycles.

Treatment information for up to 6 months after diagnosis was confirmed based on the International Classification of Disease 9th edition Clinical Classification (ICD-9-CM) procedure codes and certain ICD-9-CM codes for lung cancer diagnosis, International Classification of Disease for Oncology, third edition (ICD-O-3) code was used for NSCLC (8046), as well as SEER therapy codes, and revenue codes in the Medicare database. Chemotherapy administration codes for each chemotherapeutic agent, cisplatin, carboplatin, gemcitabine, pemetrexed, bevacizumab, paclitaxel, and docetaxel were used to determine treatment against the NCCN clinical guidelines. If a patient received a claim for concurrent cisplatin, etoposide and radiation or cisplatin plus etoposide on the same date of service they were considered to have received therapy according to the NCCN clinical practice guidelines. For stage IV disease, if a patient received a claim on the same date of service for a combination of cisplatin plus a taxane,

pemetrexed plus platinum, gemcitabine plus platinum or a taxane plus platinum plus bevacizumab they were considered to have received treatment according to the NCCN clinical practice guidelines.

Methodology

Population Characteristics

To be included in the study patients had to have a confirmed diagnosis of NSCLC, have stage IIIB/IV NSCLC, and be age 65 years or older at the time of diagnosis. Patients were of Caucasian, African American, or Hispanic race/ethnicity and stratified based on stage of disease and histology into four groups. The four groups will be stage IIIB with adenocarcinoma or squamous cell carcinoma and stage IV disease with adenocarcinoma or squamous cell carcinoma. Other factors that were adjusted for based on treatment were gender and age to determine the influence of these variables on the likelihood of receiving first line treatment according to the NCCN clinical practice guidelines. All patients were covered only by Medicare insurance at the time of diagnosis as patients covered by a HMO or other type of insurance may have different patterns of care.

Sampling Procedures

Patients were extracted from the linked SEER-Medicare database**.** A total of 250,045 lung cancer patients were included in the SEER-Medicare database. In order to draw valid conclusions about the data from this study the following statistical parameters were applied. The sample for this research consisted of all Medicare patients age 65 years or older who were diagnosed with NSCLC between 1998-2010 and filed a

Medicare claim during this same time period. Patients were selected based on the International Classification Disease for Oncology (ICD-O-3) code for NSCLC. SEER provides data on patient demographics, cancer stage, histology, and date of diagnosis. Medicare claims provide chemotherapy administered, and first treatment beginning and ending dates. The month and year were used to determine date of diagnosis. The MEDPAR, physician, and DME claims data were used to gather information about chemotherapy treatment. The NCH files were used to find radiation claims. The dose of radiation received was not provided but the duration of therapy was provided. Nursing home records, health maintenance organization records, and Medicare denied claims were omitted from the MEDPAR database. The drug specific codes were identified for paclitaxel, docetaxel, cisplatin, carboplatin, pemetrexed, gemcitabine, vinorelbine, and bevacizumab as well as the treatment code for radiation. Patients were coded as "yes or "no" as having received the recommended treatment combination in the first-line setting or did not receive recommended combination treatment.

Sample Size and Statistics

The study objective was to detect whether a statistically significant difference exists between race/ethnicity within strata defined by tumor stage and histology, according to the first line treatment of NSCLC according to the NCCN clinical practice guidelines while controlling for age and gender. This study used multivariable logistic regression to determine if there were differences in the first line treatment of lung cancer. Regressions models were developed for each of the strata of stage and histology. A binary logistic regression model was appropriate as the dependent variable is

dichotomous and there were one or more independent variables. To determine if a statistically significant difference existed the statistical power, alpha, and effect size was determined. A high statistical power improved the chance that the results were not due to chance alone. The minimum accepted value for power (1-ß) is 80% (0.8) meant that there was an 8 out of 10 chance of rejecting the null hypothesis. The alpha for this study was set at .05 for a two-tailed test, which meant there was be a 95% chance the correct conclusion will be reached. The confidence level was set at 95% and statistical significance $p \leq 0.05$. An adjusted odds ratio (OR) representing the odds for receiving a given treatment type by race/ethnicity as a function of age, stage of disease and histology was determined, and the corresponding 95% confidence interval (95% CI) was calculated. If the OR was statistically equivalent to "one" or unity (e.g., 95% CI for the adjusted OR contains 1 and the *p* value for the adjusted OR is greater the 0.05) there was a difference for a particular treatment as the first line therapy between two racial/ethnic groups. If the OR was statistically different from "one" or unity (e.g., 95% CI for the adjusted OR does not contain 1 and the *p* value was less than 0.05) there was a difference for a particular treatment type in the first line setting between racial/ethnic groups. All of these statistical parameters were the standard norm in epidemiologic and biomedical research (Dakhale, Hiware, Shinde, & Mahatme, 2012). G* Power was the statistical tool to determine power analyses and effect size for a variety of statistical tests (Faul, Erdfelder, Buchner, & Lang, 2009). Power analysis for a logistic regression was conducted using the G*Power 3.1 statistical power calculator to determine the sample size based on an alpha = 0.05, ß = 0.80, 2-sided tails, and an odds ratio = 1.44. To detect

a small size effect an odds ratio of 1.44 was assumed (Nandy, 2012). This study provided adequate number of patients and power to detect a difference between race/ethnicity.

Data Source

The NCI SEER/Medicare database links the demographic and tumor data from the SEER database with the Medicare claims filed from the CMS. SEER collects data from 18 cancer center registries throughout the United States that represents 28% of the U.S. population (NCI, 2013). SEER data are available from 1973 to 2013 and Medicare data are available from 1991 to 2010 (NCI, 2013). The patients selected for inclusion in this study were diagnosed with stage IIIB/IV NSCLC from 2009 to 2013. Patients diagnosed by a death certificate were not included. SEER data are available for patient age, gender, race/ethnicity, tumor site, stage of disease, tumor histology, date of diagnosis, and initial treatment. All Medicare claims have fields for race, gender, date of service, as well as diagnostic and procedure codes (Warren et al., 2002). In addition, the SEER-Medicare claims data include claims from the hospital, outpatient clinics, physicians, home healthcare, and hospice providers (Warren et al, 2002). Medicare claims data were used to obtain the specific chemotherapy administered. SEER-Medicare data are available for 93% of participant's age 65 or older (NCI, 2013, Engels et al., 2011). Ninety-six percent of individuals enrolled in Part A Medicare also have Part B Medicare coverage, which covers physician and outpatient services (NCI, 2013). The Medicare claims data were used to identify the chemotherapy administered. The individual drug codes were used to identify chemotherapy administration. Using this

large database will provide a better understanding of real world patterns of care among NSCLC patients of different races/ethnicities and is more representative of the elderly population who carry most of the burden of NSCLC. The SEER database does not collect data from patients with Medicare as a second insurer, patients enrolled in an HMO, or patients receiving care at a Veteran Administration Hospital (NCI, 2012).

Inclusion Criteria

Patients from the SEER-Medicare database were included in the study if they had a confirmed diagnosis of NSCLC from 1998–2010, were age 65 years or older, were treated within 6 months of diagnosis, and if there was at least one claim filed for chemotherapy. The characteristics of the study cohort for inclusion to the study are,

1. Age, 65 years and older
2. Gender, male and female
3. Race, Caucasian, African American, and Hispanic
4. Histology, adenocarcinoma and squamous cell carcinoma
5. Stage of disease, stage IIIB and stage IV

Patients in the SEER database were excluded from study if they were diagnosed with NSCLC before the age of 65 years. Patients younger than 65 years of age were not included in the Medicare database however they may be included in the SEER database. Most patients with lung cancer were diagnosed with advanced stage disease, as such, patients with a diagnosis of stage I, II, or IIIA NSCLC at age 65 were excluded from the study cohort. Patients with a diagnosis of NSCLC prior to the enrollment in Medicare were excluded as they may be treated differently from Medicare patients. Patients with a

diagnosis of small cell lung cancer, a concurrent cancer, or any other previous cancer were excluded. Patients with end-stage renal disease or a medical disability are covered under Medicare; however, these patients were excluded from this study. Patients with missing data for any of the study variables were categorized as unknown and not included in the analysis, i.e., there was not imputation for missing data. Patients of Asian, American Indian/Native Alaskan, Native Hawaiian, or other Pacific Islander race/ethnicity were not included in the study cohort. The Alaska and Arizona registries were excluded from analysis as SEER only captures information on American Indian and Alaska Natives in these states (NCI, n.d.).

Gaining Access to the Data

The SEER-Medicare database is a large population cohort of cancer patients that allows for the longitudinal study of treatment procedures and treatment administration. The database has been used extensively for disparity research and outcomes research and is a standard tool that researchers use to evaluate patterns of care and outcomes in oncology (Clegg et al., 2007). The database is also used for studies in public health policy and planning (Engels et al, 2010; NCI, 2010).

Because the SEER-Medicare linked database is not open to the public permission must be granted for its use in research and to also maintain the confidentiality of the patients and the healthcare providers. The SEER- Medicare data set is considered a limited dataset by Health Insurance Portability and Accountability Act (HIPPA) and as such a data use agreement for requesting lung cancer data was signed by the committee chairperson and myself prior to receiving access to the SEER-Medicare files. A Walden

IRB approved proposal was submitted to the SEER-Medicare reviewers for approval prior to the release of the requested databases.

Data Analysis

A multivariable logistic regression was conducted to analyze the data from the SEER-Medicare database, using the Statistical Packages for the Social Science (SPSS). Baseline demographics and patient clinical characteristics were analyzed using measures of central tendency (e.g., means, medians) and spread (standard deviations, SD; range) and frequency counts and percentages for categorical variables (e.g., gender). Race/ethnicity, age, and gender were the independent variables that determined the treatment in the first line setting. The dependent variable was dichotomous and defined as either "yes" or "no" (e.g., patient received taxane plus platinum vs. patient did not receive taxane plus platinum). Patients were stratified according to stage of disease and histology and within each strata age and gender were controlled. Univariate and multivariate regression analysis were performed to compare the likelihood of receiving treatment according the practice guidelines within stage and histology strata. A regression analysis tested if the criterion variable was linearly related to the covariates of age and gender. In order to understand the variance in the dependent variables a table was developed for R^2. A classification table was developed to estimate the percent of cases correctly classified as receiving first-line treatment with each independent variable added to the model, the probability of the outcome occurring, the sensitivity, and specificity. A third table showed the contribution of each independent variable to the regression model and its statistical significance. The p values were evaluated for each

covariate to determine the statistic evidence for the contribution to the model. The *OR* indicated the likelihood of receiving the recommended treatment based on the clinical practice guidelines and based on the independent variables. The confidence intervals were established using the odds ratio. The final logistic regression model pooled the observations according to probabilities assessed with the goodness-of-fit statistic (Homer & Lemeshow, 1989). Missing data was not included in the final analysis thereby allowing for a complete case analysis to be conducted (Piggott, 2001). This study was exploratory in nature and therefore there was no adjustment for multiplicity. It was recognized there was the potential for inflated type I error; this is discussed in Chapter 5. All statistical analyses were performed using IBM SPSS 23.0 (IBM SPSS Statistics 23.0 August 2016, Armonk, NY).

Instrumentation and Operationalization Constructs

The NCI's SEER database is the one of the largest population-based cancer databases in the U.S. and is considered that standard for quality among cancer registries (NCI, 2010). Since 1972 SEER has collected data and monitored cancer trends, cancer incidence, diagnosis, therapy, and survival (NCI, 2010). SEER collects cancer data from select state tumor registries (Alaska, Arizona, California, Connecticut, Georgia, Hawaii, Iowa, Kentucky, Louisiana, Michigan, New Jersey, Utah, and Washington) that cover 18 geographic regions to represent the diverse population in the U. S (NCI, 2010; Engels et al, 2010). While the database may represent the diverse race/ethnicities in the United States, the database tends to represent more urban than rural areas (Engels et al, 2010).

SEER also contains slightly more foreign-born cases (18%) as compared to13% in the general U.S. population (NCI, n.d.).

Reliability and Validity

The SEER-Medicare database allows for the longitudinal study of treatment procedures and treatment administration. The database has been extensively used for disparity research and outcomes research and is a standard tool that researchers use to evaluate patterns of care and outcomes (Clegg et al., 2007). The database is also used for studies in public health policy and planning (Engels et al., 2010; NCI, 2010).

The reliability of the data from the SEER database has been previously reported (Abel, 2011; Engels et al., 2010). The SEER-Medicare data have been used in over 900 previously published studies evaluating cancer patterns of care, quality of care, cost of treatment, and cancer disparities (NCI, 2010). This NCI and CMS supported database is one the largest and most comprehensive epidemiologic surveillance cancer databases that contain over 1.6 million cancer patients. Maintaining the quality of the SEER data for completeness and quality has been ongoing since the database was initiated in the 1970's (Clegg et al., 2007). As well the SEER-Medicare database is updated biennially (Engels et al., 2010). Utilizing a large population database like the SEER-Medicare database allows for tracking cancer overtime.

This study assessed the association between race/ethnicity and first line NSCLC treatment and treatment according to the clinical practice guidelines; therefore, it was not be possible to establish causation. Internal validity for a correlation study will be weaker than for an experimental deign study. As with any retrospective study, data may be

incomplete or inaccurate. For example, there may be limited or missing data on the use of tobacco, performance status, or co-morbidities (Engels et al., 2010). Data regarding age, date of diagnosis, stage of disease, and cancer histology in the SEER database were found to be fairly accurate (Field, Smith & Lynch, 2004; Field et al., 2004). Utilizing the SEER-Medicare database only allowed for generalization to the elderly population aged 65 years and older with NSCLC.

Ethical Procedures

Protecting patient information is of paramount importance with this study. An informed consent from the patient was not required for this research study; however, all reasonable measures were taken to protect the SEER-Medicare data. The database was on a device that is password protected. To protect patient anonymity, certain data within the SEER-Medicare database were restricted and not included as part of the files. These variables include patient census track zip codes and the zip codes for physicians and hospitals (SEER-Medicare, 2014). In addition, the hospital and physician name were encrypted. The NCI and Walden University requirements regarding the protection of patients, healthcare facilities, and providers were followed. The NCI requirements regarding cell sizes were followed when conducting statistical analyses to prevent the potential identification of patients. All files received from the NCI, SEER-Medicare database for this research will be destroyed at the completion of the study as required by the NCI and the NCI will be notified of destruction. As noted previously, approval from the IRB at Walden University was necessary prior to requesting data from SEER. IRB approval # 06-05-15-0174312 was granted. Approval by the SEER managers prior to

initiating the data analysis was also necessary. A copy of the Data Use Agreement (DUA) and the approval letter to use the SEER-Medicare database is provided in the appendix (Appendix A). There are no conflicts of interest.

Summary

In summary, this quantitative retrospective study using the NCI SEER database linked to the Medicare insurance database between 2009-2013 was conducted to answer the question of the likelihood of being treated according to the NCCN treatment guidelines in the first line setting taking into consideration race/ethnicity, age, gender, stage of disease and histology. In the presence of clinical practice guidelines it is unclear if disparities exist when treating NSCLC patients. Chapter 3 described the methodology for this research study, including the overall study design, study population, sampling techniques, data collection, and ethical considerations. Data analysis and issues pertaining to reliability and validity of the SEER-Medicare database were also addressed. Chapter 4 summarizes the data based upon the statistical analyses described in this chapter. Chapter 5 provides a summary and interpretation of the study results and recommendations for future research.

Chapter 4: Results

Introduction

The purpose of this retrospective population-based cohort study was to evaluate the relationship between Caucasian, African American, and Hispanic race/ethnicity, as stratified by histology (squamous vs. adenocarcinoma), and stage of disease (stage IIIB or IV) to the receipt of first-line treatment for NSCLC). To understand the differences in treatment of first-line NSCLC by race/ethnicity, an evaluation of NSCLC patients aged 65 years and older was conducted using the NCI's SEER-Medicare linked database. SEER is the most comprehensive clinical database for cancer research and includes patients' demographic, clinical, and treatment information. SEER also provides information on patients from across the United States receiving treatment in different treatment centers, both community and academic centers, which makes the analysis more representative of the total cancer patient population. The SEER database linked with the Medicare database combines the patient clinical information with insurance claims and is also the only source of population-based information in the United States that includes stage of cancer at the time of diagnosis. The SEER-Medicare database allows for the longitudinal study of patients 65 years and older over the course of their diagnosis and treatment. The database also provides the power to evaluate regional treatment and disparities among race/ethnicity.

The results of the data analysis in Chapter 4 are presented in tables to describe the findings of the study. The demographic variables (age, gender, and geographic location) were cross-tabulated by ethnic groups (Caucasians, African Americans, and Hispanics)

for comparison. Descriptive statistics are shown based on each of the racial/ethnic groups studied. Stage of disease and histology were considered possible confounding variables. The results from the logistic regression analyses are described and organized by ethnicity to provide comparisons for stage and histology.

The research question and hypotheses that were studied are as follows:

What is the likelihood of Caucasian, African American, and Hispanic patients with NSCLC are being treated equally according to the National Comprehensive Cancer Network (NCCN) practice guidelines within stage and histology strata after controlling for age, gender, and geographic location?

$H_0$1: Caucasian and African American patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location.

$H_1$1: Caucasian and African American patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology after controlling for age, gender, and geographic location.

$H_0$2: Caucasian and Hispanic patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location.

$H_1$2: Caucasian and Hispanic patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location.

H_o3: Hispanic and African American patients with NSCLC are equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location.

H_13: Hispanic and African American patients with NSCLC are not equally likely to be treated according to the NCCN treatment guidelines within stage and histology strata after controlling for age, gender, and geographic location.

This chapter details the data collection methods and the quantitative analysis conducted. Under the research question the patient characteristics and the results are described. A logistic regression analysis was conducted and the results were related to the research question. Baseline descriptive statistics were also reviewed. The chapter concludes with a summary section that provides answers to the research questions and then transitions to Chapter 5.

Data Collection

For this study, I used a secondary analysis of data obtained from the NCI-SEER database. After Walden University's Institutional Review Board (IRB) approved the research, a proposal was submitted to the NCI to obtain the SEER-Medicare data for patients with lung cancer. After approving the proposal, the NCI provided a DVD with the SEER and Medicare claims data sets for lung cancer for the years 2009 through 2013 for analysis. The data on the DVD were uploaded onto an external server where the data were analyzed and stored for the duration of the analysis. The data were prepared and analyzed using IBM-SPSS 23.0.

The SEER-Medicare database contained data on patients diagnosed with lung cancer between 2009 and 2013. The inclusion criteria for the cases included having tumors of the lung and bronchus as well as being at least 65 years of age at diagnosis. Individual data for each case were collected included ethnicity age, gender, geographic location, stage of disease (stage IIIB or IV), histology, and treatment. The independent variables in this study were age, gender, stage of disease, histology, and geographic location. The dichotomized response variable in the logistic regression model was whether the treatment provided was in accordance with the NCCN treatment guidelines. The initial sample size was 77,367 cases with 12,341 cases used in the logistic regression model. Patients were excluded if they had stage I, II, or IIIA NSCLC, if they had a previous or concurrent cancer other than basal cell carcinoma, had a lung cancer histology other than adenocarcinoma or squamous cell carcinoma, were not enrolled in Medicare Part A and Part B at the time of diagnosis, or were enrolled in Medicare as a result of end-stage renal disease or disability and were less than 65 years of age. As a result of these exclusion criteria, 14,882 cases were available for analysis. These cases were then matched with their Medicare records and an additional 2,541 patients were unable to be matched with Medicare claims, resulting in a final number of 12,341 patients. Figure 4 describes the selection process for patient inclusion.

Total number of SEER patients with a diagnosis of NSCLC N= 77,367
Exclude patients diagnosed stage with stage I, II, IIIA NSCLC N= 34,050
Exclude patients with a diagnosis of small cell lung cancer N= 6,943
Exclude patients with histology other than adenocarcinoma or squamous cell carcinoma N= 8,441
Exclude patients with previous or concurrent cancer excluding basal cell carcinoma of skin N= 4,537
Exclude patients younger than 65 years of age at diagnosis N= 4, 123
Exclude patients enrolled in Medicare with end stage renal disease N= 2348
Exclude patients not enrolled in Part A and B Medicare N= 927
Patients unable to be matched with Medicare claims N= 2,541
Final number of patients included in study cohort N= 12, 341

Figure 4. Flow diagram showing patient selection process

The final sample for this study included Caucasian, African American, and Hispanic patients with Medicare coverage who were at least 65 years of age, and had been diagnosed with stage IIIB or stage IV NSCLC. All patients had Part A and Part B Medicare coverage at the time of diagnosis and continuously during their treatment.

The SEER-Medicare linked data set represents the 18 SEER registry areas only and therefore only approximately represents the general population. Patients from the SEER registry may not be representative of the general population in the United States

diagnosed with NSCLC as some patient groups were underrepresented, such as African Americans and Hispanics. Age and gender in the SEER-Medicare dataset generally are representative of the general population.

Results

Descriptive Statistics

The final number of patients who met the inclusion and exclusion criteria for the study in these analyses was 12,341. The demographic variables were summarized by race/ethnicity using frequency distributions. The results of this analysis are presented in Table 2. The largest percent of patients (n = 2,929, 23.7%) were between 70 and 74 years of age, with those diagnosed at 85 years and older (n = 1,533, 14.5%) representing the smallest group. There were slightly more male patients (n = 6,630, 53.7%), than female patients (n = 5,711, 46.3%) included in the analysis. Most patients included in the study were Caucasian (10,940, 88.6%), with 1,245 (10.1%) African American, and 156 (1.3%) Hispanic. The majority of the patients (72.3%) had stage IV metastatic disease and 27.5% had stage IIIB disease. There were 3,398 patients (27.5%) presenting with stage IIIB disease. The histology with the largest number of participants was adenocarcinoma (72.3%), while 27.7% had squamous cell. Geographically the largest percent of patients were from the West (37.6%), and lowest percent was in the Midwest (13.4%).

Within race/ethnicity patient characteristics were fairly well balanced for squamous cell histology, stage, and gender (table 2). Across race/ethnicity for geographic location, 81.4% of Hispanics lived in the West compared to 39.0% of

Caucasians and 20.6% of African Americans. Forty-five percent of African Americans lived in the South, compared with 27.1% of Caucasians and 3.2% of Hispanics. There were no Hispanics in the Midwest region. For age at diagnosis, race/ethnicity was fairly well balanced for ages 65-69 and 70-74 years. Nearly one-quarter of African-Americans (23.8%) were aged 75-79 years, closely followed by Caucasians (23.1%) and lastly, Hispanics (10.9%). Hispanics were generally older than other racial/ethnic groups. Nearly one-third of Hispanics (32.1%) were age 80-84 followed by nearly 20% of Caucasians (19.4%) and lastly African Americans (14.2%). For patients age 85 and older 20.5% were Hispanic, 12.8% were Caucasians, and 8.2% were African American.

Table 2

Clinical and Demographic Characteristics by Race/Ethnicity (N=12,341)

Characteristics	Caucasian *n* =10,940	African American *n*= 1,245	Hispanic *n* =156
Age at Diagnosis, N (%)			
65-69	2322 (21.2)	335 (26.9)	32 (20.5)
70-74	2569 (23.5)	335 (26.9)	25 (16.0)
75-79	2531 (23.1)	296 (23.8)	17 (10.9)
80-84	2911 (19.4)	177 (14.2)	50 (32.1)
85 and older	1399 (12.8)	102 (8.2)	32 (20.5)
Gender, N (%)			
Male	5822 (53.2)	710 (57.0)	98 (62.8)
Female	5118 (46.8)	535 (43.0)	58 (37.2)
Stage, N (%)			
IIIB	3005 (27.5)	356 (28.6)	37 (23.7)
IV	7935 (72.5)	889 (71.4)	119 (76.3)
Histology			
Adenocarcinoma	7944 (72.6)	869 (69.8)	115 (37.7)
Squamous Cell	2996 (27.4)	376 (30.2)	41 (26.3)
Geographic Location N (%)			
Northeast	2256 (20.6)	226 (18.2)	24 (15.4)
Midwest	1459 (13.2)	198 (15.9)	0 (0)
South	2962 (27.1)	565 (45.4)	5 (3.2)
West	4263 (39.0)	256 (20.6)	127 (81.4)

Patient treatment in accordance to NCCN treatment guidelines was cross-tabulated by race/ethnicity. An analysis was also cross-tabulated by gender, age, stage of disease, and geographic location within race/ethnicity and these analyses are presented in Tables 4-8. The total number of participants' treated according to NCCN guidelines by race/ethnicity are shown in Table 3.

Table 3

*Treatment According to NCCN Guidelines by Race/Ethnicity (*N = *12, 341)*

	Treatment According to NCCN Guidelines					
Ethnicity	Caucasian		African American		Hispanic	
	n	%	*n*	%	*n*	%
Yes	858	7.9	78	6.3	7	4.5
No	10082	92.1	1167	93.7	149	95.5
Total	10940	100.0	1245	100.0	156	100.0

A total of 10,940 Caucasians were included in the analysis, of which 858 (7.9%) were treated according to the NCCN guidelines, followed by 78 African Americans (6.3%), and 7 (4.5%) Hispanics.

Table 4

Treatment According to NCCN Guidelines by Stage of Disease and Race/Ethnicity (N = 12, 341)

Stage of disease	Treatment to guidelines	Caucasian *n* (%)	African American *n* (%)	Hispanic *n* (%)	Total *n*
Stage IIIB	Yes	398 (13.2)	45 (12.6)	2 (5.4)	445 (13.1)
	No	2607 (86.8)	311 (87.4)	35 (94.6)	2,953 (86.9)
Stage IV	Yes	460 (5.8)	33 (3.7)	5 (4.2)	498 (5.6)
	No	7475 (94.2)	856 (96.3)	114 (95.8)	8,445 (94.4)

When evaluating stage of disease (Table 4), there were fewer patients with stage IIIB disease than stage IV disease. Of the total 3,398 patients with stage IIIB disease, 445 patients (13.1%) were treated according to the NCCN guidelines, including 13.2% of Caucasians followed by African Americans (12.6%) and Hispanic patients (5.4%). Of the total 8,943 patients with stage IV disease, 498 (5.6%) were treated according to the guidelines. There were 460 Caucasian patients (5.8%) with stage IV disease treated according to the guidelines, 5 Hispanic patients (4.2%), and 33 African Americans (3.7) treated according to the guidelines.

Table 5

Treatment According to the NCCN Guidelines by Histology and Race/Ethnicity (N= 12,234)

Histology	Caucasian *n* (%)	African American *n* (%)	Hispanic *n* (%)	Total *n*
Adenocarcinoma				
Yes	560 (7.0)	55 (6.3)	5 (4.3)	620
No	7384 (93.0)	814 (93.7)	110 (95.5)	8308
Squamous				
Yes	298 (9.9)	23 (6.1)	2 (4.9)	323
No	2698 (90.1)	353 (93.9)	39 (95.1)	3090

For histology (Table 5), there were a total of 3,413 patients diagnosed with squamous cell lung cancer, with 323 (9.5%) receiving treatment according to NCCN guidelines. Among the total 8,928 patients who had adenocarcinoma, 620 (6.9 %) were receiving treatment according to NCCN guidelines. Seven percent of Caucasians with adenocarcinoma were treated according to the guidelines, followed by African Americans (6.3%), and Hispanics (4.3%). Approximately 10% of Caucasians with squamous cell carcinoma were treated according to the guidelines (9.9%), followed by African Americans (6.1%), and Hispanics (4.9%).

Table 6

Treatment According to NCCN Guidelines by Age and Race/Ethnicity (N = 12, 341)

Age at diagnosis (years)	Treatment to guidelines	Caucasian *n* (%)	African American *n* (%)	Hispanic *n* (%)	Total *n* (%)
65-69	Yes	258 (11.1)	32 (9.6)	3 (9.4)	293 (10.9)
70-74	Yes	233 (9.1)	17 (5.1)	1 (4.0)	251 (8.6)
75-79	Yes	214 (8.5)	21 (7.1)	0 (0)	235 (8.3)
80-84	Yes	115 (5.4)	8 (4.5)	3 (6.0)	126 (5.4)
85 +	Yes	38 (2.7)	0 (0)	0 (0)	38 (2.5)

Table 6 shows the number and percent of patients in each age group by race/ethnicity treated according to the guidelines as a percent of the total number of patients for the age group. There were a total 2,686 patients in the age group 65-69 of which 10.9% were treated according to the NCCN guidelines. Eleven percent of Caucasians in the 65-69 year age group were treated according to the guidelines, followed by 9.6% of African Americans, and 9.4% of Hispanics. For patients aged 70-74 years, a total of 251 patients (8.6%) were treated according to the guidelines, including 9.1% of Caucasians, 5.1 % of African American patients, and 4.0 % of Hispanics. A total of 235 patients (8.3%) aged 75-79 treated according to the NCCN guidelines. There were 214 Caucasian patients (8.5%) and 21 (7.1%) African Americans treated appropriately.

There were no Hispanic patients in the 75-79 aged group treated according to guidelines. In the 80-84 year aged group there were a total of 126 patients (5.4%) treated according to guidelines; 5.4% of Caucasians, 6.0% of Hispanics, and 4.5% of African American. The lowest percent of patients treated according to the guidelines were in the 85 and older age group (2.5%) and were all Caucasians.

Table 7

*Treatment According to NCCN Guidelines by Gender (*N = *12, 341)*

Gender	Treatment to the guidelines	Caucasian *n* (%)	African American *n* (%)	Hispanic *n* (%)	Total *n* (%)
Male	Yes	476 (8.2)	52 (7.3)	6 (6.1)	534 (8.1)
Female	Yes	382 (7.5)	26 (4.9)	1 (1.7)	409 (7.2)

Table 7 represents the percentage of male and female patients treated according to the guidelines with each race/ethnic group. Of the total 6, 630 males, 534 (8.1%) were treated in accordance with the NCCN guidelines and of the total 5,711 females 409 (7.2%) were treated according to the guidelines. Within each racial/ethnic group a lower percentage of females than males received guideline appropriate treatment. There were 382 (7.5%) female Caucasian patients who received guideline appropriate treatment followed by 26 (4.9%) female African American patients, and 1 (1.7%) female Hispanic patient that received treatment according to the guidelines. In comparison, 8.2% Caucasian males were treated according to the guidelines followed by 7.3% of African

American males, and 6.1% of Hispanic males that received treatment according to the NCCN guidelines.

Table 8

Treatment According to NCCN Guidelines by Region and Race/Ethnicity (N= 12, 234)

Geographic region	Treatment to Guidelines	Caucasian *n* (%)	African American *n* (%)	Hispanic *n* (%)	Total *n* (%)
Northeast	Yes	183 (8.1)	14 (6.2)	1 (4.2)	198 (7.9)
Midwest	Yes	134 (9.2)	8 (4.0)	0 (0)	142 (8.6)
South	Yes	242 (8.2)	41 (7.3)	0 (0)	283 (8.0)
West	Yes	299 (7.0)	15 (5.9)	6 (4.7)	320 (6.9)

Table 8 shows the percent of patients by region within each racial/ethnic group who were treated according to the NCCN guidelines as a percent of the total number of patients in each region. There were a total of 198 (7.9%) patients in the Northeast, 142 (8.6%) patients in the Midwest, 282 (8.0%) patients in the South, and 320 (6.9%) patients in the West received treatment according to the guidelines. Across all regions a larger percent of Caucasians received appropriate treatment to the guidelines as compared to African American and Hispanic patients. There were no Hispanic patients in the Midwest or South that received treatment according to the NCCN guideline.

Logistic Regression Overview

A regression analysis was conducted that included all independent and covariate variables entered simultaneously into the analysis (Table 9). The dependent variable was

treatment according to the NCCN guidelines. The full regression model reveals there was a significant difference between African Americans compared to Caucasians treated according to the guidelines *OR*= .68[95% CI (.54, .88, p= .002)]. There was a 32% decrease in the odds of African Americans being treated according to the guidelines. There was not a statistically significant difference between Caucasians and Hispanics (p= .373). The results of the full model show that as age increased the odds of being treated in accordance to the guidelines decreased. The results of the full model show that age at diagnosis was statistically significant for all age groups and had a negative correlation to treatment. Results revealed that gender was not significant predictor *OR* = .92 (95% CI [.80, 1.0, *p* = .210]).

Geographic region was associated with receiving treatment according the NCCN guidelines; patients living in the West had lower odds *OR* = 0.82, (95% CI [.68, .99, p = .036]) of receiving treatment according to NCCN guidelines as compared to patients in the Northeast. The results of each logistic regression model are presented by and categorized by stage of disease and histology (e.g., stage IIIB adenosquamous, stage IV adenocarcinoma, stage IV squamous cell) with comparisons by race/ethnicity, Caucasian compared to African American and Hispanics and African Americans compared to Hispanics. (Tables 10-15)

Table 9

Full Logistic Regression with all Variables and Covariates for Treatment According to the NCCN Guidelines

	B	Wald	*OR*	CI lower	CI upper	*p*-value
Age Group		128.55				
70-74	-.28	9.47	.75	.63	.90	.002
75-79	-.36	15.22	.70	.58	.83	<.000
80-84	-.88	59.63	.42	.34	.52	<.000
85+	-1.70	92.27	.18	.12	.25	<.000
Female	-.098	1.57	.92	.80	1.06	.210
Race/Ethnicity		9.86				
African American	-.378	9.15	.68	.54	.88	.002
Hispanic	-.35	.79	.70	.33	1.53	.373
Geographic Location		6.77				
Midwest	.03	.07	1.03	.82	1.30	.798
South	-.10	1.10	.90	.74	1.10	.295
West	-.20	4.41	.82	.68	.99	.036
Squamous cell	.27	9.31	1.25	1.08	1.45	.002
Stage IV	-1.00	203.91	.37	.32	.42	<.000

Research Question and Hypotheses

In the sections that follow, pair wise comparisons for the racial/ethnic groups within strata defined by stage of disease and histology are provided.

Caucasians Compared to African Americans

The first pair wise comparison was between Caucasians and African Americans.

Stage IIIB Adenosquamous Carcinoma

Of the 3398 patients with stage IIIB NSCLC, 2,953 patients were not treated according to the NCCN guidelines, and 455 patients were treated according to the NCCN guidelines included in this model.

There was not a significant difference between Caucasians and African American patients treated per the guidelines OR= .812 (95% CI [.58, 1.137, p= .225]). The odds of females being treated according to the guidelines were not significantly different from males, OR = .93 (95% CI [.76, 1.14, p = .478]). The odds were less that patients age 85 and older were treated according to the guidelines (OR= .225, [95% CI .14, .35, p= 0.000]), when compared to patients' aged 65 to 69. Patients living in the West had 30% lower odds of receiving treatment according to the guidelines when compared with those in the Northeast OR= .699 (95% CI [.51, .90, p= .008]). Patients in the Midwest had 23% higher odds of not being treated according to NCCN guidelines OR=1.23 (95% CI [.92, 1.78, p= .150]) compared to those living in the Northeast.

Table 10

Results of Logistic Regression of Caucasian Patients Compared to African American Patients within Stage IIIB Adenosquamous Carcinoma

	Wald	*OR*	CI lower	CI upper	*p*-value
Age Group					
65-69	55.38				
70-74	2.62	.79	.59	1.05	.106
75-79	1.89	.82	.62	1.09	.169
80-84	21.02	.47	.34	.65	.000
85+	42.08	.22	.14	.35	.000
Geographic Region					
Northeast	18.12				
Midwest	2.07	1.23	.917	1.78	.150
South	.108	.95	.715	1.27	.743
West	6.99	.68	.510	.90	.008
Race/Ethnicity					
Caucasian	2.186				
African American	1.47	.812	.58	1.137	.225
Gender					
Female	.50	.93	.76	1.14	.478

Stage IV Adenocarcinoma

Table 11 presents results for Caucasian patients compared with African American patients with stage IV adenocarcinoma. There were 386 patients treated according to the NCCN guidelines and 6,263 patients were not treated according to the guidelines.

A comparison of Caucasian and African Americans with stage IV adenocarcinoma revealed race/ethnicity was statistically significant for predicting treatment *OR* = 625(95% CI [.417,938 *p*= .023]). The odds of African Americans with stage IV adenocarcinoma being treated according to the guidelines decreased by nearly 38% OR= .625, (95% CI [.47, .938 *p*= .023). Age at diagnosis within all age groups was statistically significant for treatment according to the guidelines. As age increased, the odds of treatment according to the guidelines decreased for all age groups as compared to patients 65-69 years of age. Geographic location and gender were not significant predictors of treatment according to the guidelines.

Table 11

Logistic Regression in Caucasian Patients Compared to African American Patients with Stage IV Adenocarinoma

	Wald	*OR*	CI lower	CI upper	*p* value
Age Group					
Age 65-69	64.81				
Age 70-74	8.88	.67	.52	.87	.003
Age 75-79	15.02	.58	.44	.76	.000
Age 80-84	30.97	.38	.27	.53	.000
Age 85+	38.92	.10	.05	.21	.000
Gender					
Female	1.09	.90	.73	1.10	.296
Race/Ethnicity					
Caucasian	5.85				
African American	5.16	.625	.417	.938	.023
Geographic Location					
Northeast					
Midwest	.02	1.03	.71	1.49	.886
South	.05	.97	.71	1.31	.828
West	.08	1.04	.79	1.38	.775

Stage IV Squamous Cell Carcinoma

Results of the pair wise analysis with Caucasian patients compared to African American patients with stage IV squamous cell carcinoma are shown in Table 12. Of the 2,294 patients with stage IV squamous cell carcinoma, 112 patients received treatment

according to the NCCN guidelines and 2, 182 patients did not receive treatment according to the NCCN guidelines.

Race/ethnicity overall was significant for treatment between Caucasians and African Americans according to the guidelines in patients with stage IV squamous carcinoma of the lung. African Americans had a nearly 59% lower odds of being treated according to NCCN guidelines when compared to Caucasians, *OR* = .413 (95% CI [.178, .957 *p*= .039]). Age at diagnosis was statistically significant in predicting treatment according to NCCN guidelines for the age groups 80 to 84 *OR* = .44 [95% CI (.221, .876 *p*= 0.19)] and 85 years and older OR= .304 [95% CI (.12, .80. *p*= .016)] were the only age groups that were statistically significant. These two age groups had lower odds of being treated according to the guidelines than patients' age 65 to 69. Patients' age 70 to 74 had a 12% higher odds of receiving treatment according to the guidelines although this result was not statistically significant (*p* = .650) when compared to Caucasian patients.

Table 12

Logistic Regression for Caucasian vs. African American Patients with Stage IV Squamous Cell Carcinoma

Patient Characteristic	Wald	*OR*	CI lower	CI upper	*p* value
Age Group					
Age 65-69	13.56				
	.205	1.12	.68	1.85	.650
Age 70-74					
	.58	.81	.42	1.39	.448
Age 75-79					
	5.46	.44	.22	.88	.019
Age 80-84					
	5.84	.30	.12	.80	.016
Age 85+					
Gender					
	1.19	.80	.53	1.20	.276
Female					
Geographic Location					
Northeast	4.70				
Midwest	3.56	.52	.26	1.03	.059
South	2.14	.68	.41	1.14	.144
West	3.08	.62	.37	1.06	.079
Race/Ethnicity					
Caucasian	4.53				
African American	4.25	.413	.178	.957	.039

Comparison of Caucasians and Hispanics

The second hypothesis was to determine if Caucasian and Hispanic patients with NSCLC were equally likely to be treated in accordance with the NCCN treatment guidelines within stage and histology strata. The pair wise comparisons are shown in Tables 13-15.

Stage IIIB Adenosquamous Carcinoma

Among patients with Stage IIIB adenosquamous carcinoma, 445 were treated according to the NCCN guidelines and 2,953 patients were not treated using these guidelines. The results are in Table 13.

Race/ethnicity was not a significant contributor in predicting treatment according to the guidelines. A non-statistical difference was found in the odds of being treated in accordance to the guidelines for Caucasians as compared to Hispanics *OR* = .93 (95% CI [.62, 1.39, *p* =0.38]). However, these results should be interpreted with caution due to the small number of Hispanics patients compared to Caucasian patients.

Age at diagnosis was significant in predicting treatment per the NCCN guidelines. Patients in age group 80 to 84 had a 53% lower odds of being treated according to the guidelines as compared to patients aged 65-69 *OR* = .47 (95% CI [.34, .65, *p* = .000]). Patients age 85 and over had 73% lower odds of receiving treatment according to the guidelines as compared to patients age 65-69. However, because of the small sample size, caution should be taken when interpreting these results.

Geographic location was statistically significant in this model for patients living in the West. For patients in the West, odds of being treated according to the guidelines

was 31% lower than patients living in the Northeast, *OR* = .69 [95% CI (.51, .90, *p* = .008)].

Table 13

Logistic Regression for Hispanic Patients Compared with Caucasian Patients with Stage IIIB Adenosquamous

Patient Characteristic	Wald	*OR*	CI lower	CI upper	*p* value
Age Group					
Age 65-69	55.38				
Age 70-74	2.62	.79	.59	1.05	.106
Age 75-79	1.89	.82	.62	1.09	.169
Age 80-84	21.02	.47	.34	.65	.000
Age 85+	42.08	.23	.14	.35	.000
Gender					
Female	.50	.93	.76	1.14	.478
Race/Ethnicity					
Caucasian	.744	.93	.62	1.39	.38
Hispanic	2.19				
Geographic Location					
Northeast	18.12				
Midwest	2.07	1.28	.92	1.78	.150
South	.11	.95	.72	1.27	.743
West	6.99	.68	.51	.90	.008

Stage IV Adenocarcinoma

A pair wise test comparing Caucasians and Hispanics being equally treated according to the NCCN guidelines are shown in Table 14. Included in this analysis were 386 patients who were treated according to the NCCN guidelines and 6,263 patients who did not receive treatment according to the NCCN guidelines.

Race/ethnicity, gender, and geographic location were not significant predictors of treatment to the guidelines. A significant difference in the odds was not found for Hispanics and Caucasian patients with stage IV adenocarcinoma *OR*= 1.68 (95% CI (.523, 5.41, p = .383)]. This result may be due to the small number of Hispanic patients in the cohort. Because few Hispanics with stage IV adenocarcinoma were included in this model compared to Caucasians, drawing conclusions is difficult.

Age at diagnosis for all age groups was the only variable that was statistically significant in predicting treatment in accordance to NCCN guidelines in patients with stage IV adenocarcinoma compared to patients age 65-69. Patients age 85 and older had the lowest odds of being treated according to the guidelines as compared to patients age 65 to 69 *OR* = .10 [95% CI (.05, .21, *p* = .000)]. As age increased, the odds of treatment to the guidelines decreased.

Table 14

Logistic Regression for Hispanic Patients Compared to Caucasian Patients with Stage IV Adenocarcinoma

Patient Characteristic	Wald	*OR*	CI lower	CI upper	*p* value
Age Group					
Age 65-69	64.81				
Age 70-74	8.88	.67	.52	.87	.003
Age 75-79	15.02	.58	.44	.76	.000
Age 80-84	30.96	.38	.37	.53	.000
Age 85+	38.92	.10	.05	.21	.000
Gender					
Female	1.09	.90	.72	1.10	.296
Race/Ethnicity					
Caucasian	.76	1.68	.52	5.41	.38
Hispanic	5.85				
Geographic Location					
Northeast	.338				
Midwest	.020	1.03	.71	1.49	.886
South	.047	.97	.71	1.31	.828
West	.082	1.04	.79	1.38	.775

Stage IV Squamous Cell Carcinoma

Among the 2,294 patient treated with stage IV squamous cell carcinoma, 112 were treated according to NCCN guidelines and 2,182 patients were not treated

according to the guidelines. The pair wise results for Hispanic patients compared to Caucasian patients with stage IV squamous cell carcinoma showed race/ethnicity was not a significant predictor of treatment according to NCCN guidelines. No valid conclusions could be drawn regarding race/ethnicity, age, or geographic location for treatment, as only 33 Hispanic patients with stage IV squamous cell carcinoma were included in the analysis compared to 2,006 Caucasian patients.

Comparison of Hispanics and African Americans

The pair wise comparison for Hispanic and African American patients with squamous cell carcinoma is shown in Table 15. Because Hispanics (n=33) are a smaller group in this study than African Americans (*n*= 255), the analysis was conducted with Hispanics as the reference group. Results of the analysis revealed a non-statistical difference in treatment between Hispanics and African American patients OR = .29 [95% CI [(.05, 1.54, *p* = .145)]. Because of the small number of Hispanic patients with stage IV squamous cell lung cancer, drawing any conclusions regarding treatment comparisons in accordance to the guidelines is difficult.

Age at diagnosis in all age groups was the only significant predictor for treatment in accordance in NCCN guidelines and indicated that as age increased the odds of being treated according to NCCN guidelines decreased. Only patients in the West showed a significant difference in treatment according to the guidelines *OR* = (95% CI [.67, .98, p= 0.04]).

The comparison of Hispanic and African American patients with stage IV adenocarcinoma, revealed there was not a statistical difference in the odds of treatment OR=1.05 (95% CI [.307, 3.59, p=. 936]) and that both groups were closely treated to the guidelines. However, due to the small sample size conclusions cannot be drawn regarding treatment according to NCCN guidelines for Hispanic and African American patients.

Table 15

Logistic Regression of Hispanic Patients Compared to African American Patients with Stage IV Squamous Cell Carcinoma

Patient Characteristics	Wald	*OR*	CI lower	CI upper	*p* value
Age					
Age 65-69	128.5				
Age 70-74	9.4	.75	.63	.90	.00
Age 75-79	15.21	.67	.58	.83	.00
Age 80-84	59.63	.42	.38	.52	.00
Age 85+	92.26	.13	.13	.26	.00
Gender					
Female	1.57	.91	.80	1.05	.21
Race/Ethnicity					
Hispanic	4.53				
African American	2.12	.287	.053	1.53	.14
Geographic Location					
Northeast	6.76				
Midwest	.66	1.030	.81	1.29	.79
South	1.97	.90	.74	1.09	.29
West	4.41	.92	.67	.98	.03

Post Hoc Analysis

Because the number of African American and Hispanic patients individually was small, their numbers were combined and a new racial/ethnic group was created and titled other race/ethnicity. The other race/ethnicity group contains 1401 patients.

A post hoc full model regression analysis was performed (Table 16). The results showed the odds of patients in the other race/ethnicity were less likely to be treated according the to guidelines than Caucasians. There was a 31% reduction in the odds of being treated according to the guidelines *OR*= 0.69, (95% CI [.534, .869, *p*= .002]). Age at diagnosis was significant in all age groups. As age increased, the odds of treatment according to the NCCN guidelines were less likely. Gender is not statistically significantly associated with treatment according to the NCCN guidelines in the post hoc analysis. There was a statistically significant difference in treatment between patients in the West as compared to patients in the Northeast *OR*= .818 (95% CI [.678, .987, *p*= .036)].

Table 16

Post Hoc Logistic Regression of Caucasian Patients Compared to Other Race/Ethnicity

Patient Characteristic	Wald	*OR*	CI lower	CI upper	*p* value
Age at Diagnosis					
65-69	128.660				
70-75	9.468	.754	.63	.90	.002
76-79	15.225	.695	.58	.83	.000
80-84	59.671	.421	.34	52	.000
85 +	92.271	.182	.13	.26	.000
Gender					
Female	1.57	.916	.799	1.050	.209
Race/Ethnicity					
Other	9.850	.687	.543	.869	.002
Region					
Northeast	6.782				
Midwest	6.5	1.030	.82	1.296	0.80
South	1.104	.90	.742	1.094	0.30
West	4.408	.818	.678	.987	.036
Stage					
IV	203.936	.37	.32	.423	.000
Histology					
Squamous Cell	9.309	1.253	1.084	1.449	.002

Summary

The purpose of this population-based cohort study was to determine the likelihood of elderly patients with stage IIIB or IV NSCLC adenocarcinoma or squamous cell carcinoma being equally treated according to the NCCN guidelines. For all research hypotheses, a binary logistic regression model was conducted controlling for covariates. Overall, the odds of treatment according to the NCCN guidelines was poor with 92.4% of patients not likely to receive treatment according to the guidelines and 7.6% of patients likely to receive treatment according to the guidelines. The results were mixed for the likelihood of being equally treated according to the guidelines for race/ethnicity.

The first hypothesis tested that Caucasians and African Americans with stage IIIB adenosquamous carcinoma were equally likely to the treated according to NCCN guideline was not retained. For Caucasian and African American patients with stage IV adenocarcinoma and stage IV squamous cell carcinoma, the null hypothesis (H_0) was rejected. Caucasian and African American patients were not equally treated according to the guidelines. The odds of African American patients being treated in accordance to the guidelines was less than for Caucasians.

The odds of Caucasian and Hispanic patients being equally treated according to the NCCN guidelines revealed no statistically significant difference; therefore, the null hypothesis was retained. However, caution should be taken when evaluating the data, due to the small number of Hispanic patients in this cohort.

The odds of Hispanics and African Americans being equally treated according to NCCN guidelines indicated they were equally likely to be treated according to the guidelines while controlling for other variables. When other factors that could affect treatment were considered, age at diagnosis was significant in all analyses, revealing that older patients were less likely to be treated according to the NCCN guidelines when compared to patients age 65-69. No differences were found in the odds of treatment according to NCCN guidelines between males and females within stage and histology for all models.

For all patient groups, patients with adenocarcinoma were less likely to receive treatment according to the guidelines as compared to patients with squamous cell carcinoma. Stage IV patients were less likely to be treated according to the guidelines than Stage III patients. In a post hoc analysis, when African American and Hispanic patients were combined to create a new race/ethnicity category, other races, there was a statistical difference between Caucasians and other races in treatment according to the NCCN guidelines, therefore the null hypothesis was not retained. Chapter 5 discusses the interpretation of the results, the limitations, recommendations for future research, and implications.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this population-based cohort study was to evaluate if patients age 65 years or older with stage IIIB or stage IV adenocarcinoma or squamous cell histology NSCLC were equally treated according to the NCCN guidelines. Specifically, this research was undertaken because few studies on cancer, including lung cancer, have looked at treatment adherence based on national clinical guidelines. National guidelines for specific patient diagnoses are used to provide patient treatment recommendations based on efficacy, toxicity, and then cost when efficacy and toxicity are equal. Failure to comply with the NCCN guidelines or other national guidelines for cancer treatment may compromise patient outcomes and increase the cost of care. Based on the results of this study, race and age at diagnosis contributed to NSCLC treatment in accordance with the NCCN guidelines.

Interpretation of Findings

The current analysis demonstrated that for patients with stage IV adenocarcinoma, the odds of African American patients being treated according to clinical guidelines were 38% less than for Caucasians patients with the same diagnosis. Among patients with stage IV squamous cell carcinoma, African American patients had 59% lower odds than Caucasian patients of being treated according to the NCCN guidelines. In the post hoc, when race/ethnicity was evaluated, there was a 31% reduced chance of patients of other race/ethnicity being treated according to the guidelines compared to Caucasians. Despite uniform health insurance coverage, the odds of being treated according to the clinical

guidelines vary. The decision to treat elderly lung cancer patients is complex. In this analysis, age at diagnosis was a significant factor for appropriate treatment. There was an inverse relationship between age and treatment according to the guidelines. These results are similar to the results from previous studies (Earle et al. 2000; Potosky et al., 2004).

Differences between Caucasian and African American patients with stage IIIB disease were not statistically significant; possibly due to the small probability that patients with stage IIIB cancer live longer than those with stage IV and can actually be cured in some cases with aggressive treatment (Simone, 2013). The lack of a significant difference between Caucasian and Hispanic patients, and between African American and Hispanic patients with stage IIIB or stage IV disease suggests that patients are equally likely to be treated according to the guidelines, and this is in agreement with previous studies (Goulart et al. 2012). However, these results can be difficult to interpret, as the number of African American and Hispanic patients in this study was insufficient to predict a difference accurately. The smaller number of Hispanic patients is a reflection of the lower incidence of smoking rates and lung cancer in Hispanic patients (Saeed et al., 2012). In addition, Hispanics with NSCLC tend to have more bronchiolalveolar histology than Caucasian or African American patients (Saeed et al. 2012). Bronchiolalveolar carcinoma, a subtype of adenocarcinoma of the lung, represents approximately 4% of NSCLC (Read, Page, Tierney, Piccirillo, & Govindan, 2004). Bronchioalveolar histology was not included in this study because most of these tumors are detected at an early stage and are usually resected (Maza, Meernik, Jeon & Cote, 2015).

Because little data is available on regional differences in the treatment of patients with cancer, I examined whether there were differences in adherence to NCCN treatment guidelines in NSCLC. This study revealed that patients with stage IIIB NSCLC living in the West were less likely to be treated according to the guidelines than patients in the Northeast. This difference may be due to more Hispanics living in the West as compared to the Northeast and regional differences among patients and physicians in beliefs regarding the treatment of advanced NSCLC. Hirth et al. (2015) noted differences in treatment according to geographic location primarily between the Northeast and the West regions. However, they found that these differences were poorly understood and might not be able to be generalized in all settings due to variations in barriers to using guidelines. A paucity of data is available about whether treatment is more aggressive in one region than another, or whether physician beliefs regarding lung cancer treatment differ across regions. Regional differences in the adherence to guidelines for the treatment of prostate cancer, colon cancer, and rectal cancer were found in Texas, and the investigators found that the differences within the state may be due to some regions being more aggressive with treatment than other region. Other reasons may be patient medical characteristics (Ho et al., 2016). Makarov et al. (2012) found regional differences in cancer imaging among the SEER regions and that regions with high levels of appropriate imaging also had high levels of inappropriate imaging. The reasons for these differences were poorly understood and may go beyond competition between health facilities (Makarov et al, 2015). Understanding specific patterns of geographic variation may need

to be evaluated at the zip code, county, and hospital level and not the larger regional level, as in the present study.

Several studies have shown that factors associated with a variation in general cancer practice guideline compliance, including the NCCN guidelines, include (a) age, (b) comorbidities, (c) insurance type, (d) institution, (e) region, (f) lack of physician awareness of guidelines, (g) lack of physician agreement with guidelines, and (h) physician time and resources (Goldberg, Akard, Dugan, Faderl, & Pecora, 2015; Ho et al., 2016). Ho et al. (2016) found that differences in the treatment of colon, prostate, and pancreatic cancer according to guidelines across Texas could be attributed to physician referral patterns, patient age, gender, being Black, and living in a lower income area.

The median age of patients in this analysis was 75-79, slightly older than patients diagnosed with lung cancer overall. Data from the SEER database showed individuals 80 years and older represent approximately 17% of lung cancer patients in the United States (Altundag et al., 2007; Chen et al., 2016; Owonikoto et al., 2007). In this study, I found that age at diagnosis was a major contributor in determining treatment according to the NCCN guidelines. Differences in treatments were observed between the patient age groups 75-79, 80-84, and over 85 years of age, as compared with patients 65-69 years for all groups. As age increased, the odds of patients being treated according to the NCCN guidelines decreased, which was similar to findings reported in other studies (Boland et al. 2013; Wang et al, 2011). This difference may be due to the patient age, patient comorbidities, and/or treatment effects/toxicity. Even with comorbidities, older patients were able to tolerate chemotherapy. Chen et al (2016) found that 7.9% of octogenarians

received chemotherapy and Potosky et al. (2004) found that 21% of octogenarians with stage III NSCLC and 16% with stage IV NSCLC received recommended lung cancer treatment. More recently, Cassidy et al. (2017) reported that patients with stage IIIB NSCLC, adenocarcinoma histology, advancing age, female gender, and who are Black received no treatment for their NSCLC. Researchers at the Association of the British Pharmaceutical Industry (ABPI) have shown that a patient's chronological age might differ from their biological age, which was based on an individual's functional capacity, and could affect receipt of appropriate treatment (ABPI, 2012). Patient age was found to be a major influential factor in the decision of how physicians treated a patient, in addition to performance status (Foster et al., 2010). A retrospective study from M. D. Anderson Cancer Center indicated that select patients with good performance status, 80 years and older, were able to tolerate standard chemotherapy and outcomes were similar to younger patients (Altundag et al., 2007). Because limited information is available from clinical trials on the use of cancer therapies in patients 70 years and older, further research is warranted.

Maintaining quality of life is an important consideration for patients receiving lung cancer treatment. Tradeoffs exist between side effects of treatment and clinical benefits. These tradeoffs vary among patients depending on how they value time. Some patients may prefer to avoid side effects, while other patients may consider side effects to be manageable and feel that benefits of treatment may offset the side effects. Some patients may not want to receive aggressive treatment if the gain in life is not significant.

Quality of life for patients and the family should be considered and discussed with the physician.

Comorbidities, such as heart disease, diabetes, pulmonary diseases, hypertension, decreased renal function, alterations in drug metabolism, and "polypharmacy," are common in elderly patients and can influence treatment decisions (Chen et al. 2016). Although elderly patients tend to have greater co-morbidity that contributes to increased toxicities, age alone should not prevent an elderly lung cancer patient from receiving treatment (NCCN Senior Adult Oncology, 2014; Tas, Ciftci, Kilic, & Karabulut, 2013; Wang et al, 2011). Because the increased risk for toxicity from chemotherapy or radiation and co-morbidities decrease the likelihood of completing all treatment cycles, physicians might decide not to treat a patient according to clinical treatment guidelines (Chen et al., 2016). In some instances, the patient or family members may request treatment discontinuation. The NCCN guidelines recommend physicians consider co-morbidities when recommending cancer treatments for the elderly (NCCN Senior Adult Oncology, 2014). Wang et al. (2011) found that when age and co-morbidity were both taken into account, elderly patients without co-morbidities were treated less frequently than younger patients with co-morbidities. They also noted that patients over 85 were treated less frequently than patients 75 and younger (Wang et al, 2011). The NCCN clinical guidelines recommend single agent chemotherapy to improve quality of life and survival in patients 70 to 86 years of age (NCCN Senior Adult Oncology 2014; Tas et al., 2013). Doublet chemotherapy showed benefits in patients 70-80 years of age that were equivalent to patients younger than 70 years (Wang, Fuller, & Thomas, 2007). While the

elderly cancer patient can be challenging to treat, they are also generally underrepresented in clinical trials due to strict exclusion criteria. Therefore, additional clinical trials specific for the elderly cancer patient are warranted to determine optimal treatment (Tas et al., 2013).

Physician barriers to clinical practice guideline use in oncology have not been studied extensively (Goldberg et al., 2015). Goldberg et al (2015) found resource barriers, lack of familiarity, and lack of agreement with the NCCN guidelines for Chronic Myelogenous Leukemia (CML) were reasons physicians did not following the guidelines. They found that 84% of physicians were familiar with the NCCN guidelines for CML, 14% of physicians were familiar with the guidelines but did not use them in treating patients, and 2% of physicians were not familiar with the NCCN guidelines for CML (Goldberg et al., 2015). Most physicians reported the guidelines were difficult to find, difficult to implement, offered few treatment options, and believed the guidelines hindered their autonomy to practice medicine (Greenberg et al. 2015). A report by the New England Healthcare Institute (2008) revealed physicians were more likely to follow guidelines if they were relevant to their practice (NEHI, 2008).

Social cognitive theory was selected as the theoretical framework for this study as it focuses on individual cognitive influences and incorporates the adoption of evidence based practice changes. Lack of awareness and familiarity of guidelines can affect physician knowledge and decisions to use the guidelines (Cabana et al., 1999). Fifty-six percent of physicians from a variety of specialties were unfamiliar with clinical guidelines and up to 91% did not agree with the guidelines. Self-efficacy and expected

patient outcomes were found to be barriers to adopting treatment guidelines by physicians (Cabana et al., 1999). Therefore, from a theoretical perspective, a lack of awareness and lack of familiarity may affect physician knowledge of the NCCN guidelines.

Limitations of the Study

The SEER-Medicare linked data set is a large population-based database that collects data for evaluating cancer care in the elderly in 97% of the United States population 65 and older. The Medicare database is an administrative database designed for tracking reimbursement claims. However, the database has its limitations when applied for clinical research purposes, such as limited detailed diagnostic information, inconsistency in the use of procedural coding, and difficulty in determining the timing of events (Virnig & Madeira, 2012). The Medicare data are based on insurance claims data, are input from tumor registrars, and are subject to errors. Because the SEER-Medicare linked database is a population-based database the data are not subject to selection bias or reporting bias. The limitations of the SEER-Medicare database relevant to this study are a lack of information regarding a patient's performance status that is used to measure how a patients disease is progressing, treatment decisions, smoking status, patient co-morbidities, weight loss, quality of life related to treatment, and reasons for not receiving treatment or refusal of treatment. Because the population was limited to individuals with Medicare (age 65 or older) the findings may not be generalized to a younger population or patients with another type of insurance. As a retrospective study, an understanding of causality cannot be determined.

Recommendations for Future Research

By 2050 approximately 50% of the population is expected to be racial/ethnic minority, thereby increasing the potential for disparities in cancer care (Gorin, Badr, Krebs & Das, 2012). Although numerous studies have been conducted showing disparities in the treatment of cancer, including lung cancer, most of these studies have been in the earlier stages of the disease. Few studies, particularly in stage IIIB lung cancer have been published that evaluate healthcare disparities in the Hispanic population. Lung cancer treatment is complex and overcoming healthcare disparities is complex and multifaceted, with several contributing factors including the age of the patient, general decrease in performance status, and comorbidities. The patient and family support system may also contribute to limited access of older patients to chemotherapy. Patient health beliefs and attitudes can influence the healthcare practitioner treatment behavior. The type of healthcare facility is among other contributing factors affecting patient treatment**.** Developing trials specifically for the elderly and enrolling a diverse racial/ethnic mix into clinical trials are needed to improve the understanding in treatment differences. Based on findings of the present analysis, additional research is needed into treatment differences according to patient age, geographic location, and compliance to clinical treatment guidelines. In addition, future research should include patient performance status; lifestyle factors, such as smoking status; and co-morbidities as these influence patient treatment decisions.

Given the findings of this study, further prospective research evaluating specific reasons why a patient is not treated consistent with the NCCN guidelines is warranted. Is

noncompliance to the guidelines the physician's decision or lack of familiarity of the guidelines? Physicians have been found to be noncompliant with guidelines cross a variety of medical specialties (Goldberg et al., 2015). Physician disagreement with the guidelines, risk versus benefit of treatment, and patient/family decisions not to receive recommended treatment have been found to influence compliance. However, it is unknown if treatment was recommended by the physician and the patient refused treatment, if the guideline treatment was offered to the patient, or for other reasons the patient refused treatment. Additional research is needed on these factors focusing on the healthcare system as it remains unclear what effect treatment differences reflect individual patient decisions or healthcare system factors.

Oncology patient care is usually conducted with a team of physicians and healthcare professionals guided by clinical practice guidelines or past experience to provide the best care. Cancer care should be collaborative or a two-way street between the healthcare professional and the patient. Physicians have limited time to spend with each patient and having open communication with the patients and their families about treatment plan and goals, toxicities of treatment, and understanding patient/family goals and needs can improve outcomes. Patients and family should be aware that the NCCN guidelines are available in lay persons terms, should become more involved in their own care and should be willing to have a discussion with their physician about their treatment goals. If a physician doubts a patient's commitment to recommended treatment, another easier treatment may be offered that is not in accordance to treatment guidelines (Martin, Williams, Haskard & DiMatteo, 2005). Improving communication between the

physician and the patient has been shown to improve patient compliance to treatment (Zolnierek & Robin, 2009)

Accurate and complete race/ethnicity information needs to be captured within large databases and registries. Encouraging patients, particularly African American and Hispanics to participate in clinical trials could help in furthering an understanding of treatment disparities on outcomes and is essential to formulate policy and design programs to address the disparities. Additional education of healthcare professionals around disparities and a better understanding of different racial/ethnic beliefs and cultural differences are needed. Breaking down racial/ethnic differences may influence treatment to the guidelines for the better. Additional research is needed to gain an understanding of how treatment decisions are made within the healthcare system

Implications

Social Change

This research contributes to positive social change by providing support for a better understanding of factors that might influence treatment according to the NCCN guidelines. Increasing an understanding of racial disparities in the quality of NSCLC care could help inform healthcare professional, policy makers, and public health professionals to focus on decreasing disparities and improving care and cancer outcomes. Basing public health initiatives, programs, research, and outcomes on evidence-based guidelines data could lead to better public understanding of disease and treatment.

Educating patients about the availability of treatment guidelines and empowering patients to take active roles in treatment decision process could go a long way to improve

quality of life and outcomes in cancer treatment. Healthcare professionals need to take an interest in what is important to the patient. While challenges to patient communication exist partially due to the complexity of the disease and treatment, healthcare professionals must continue to improve communication with patients and engage patients in their own care.

Conclusions

In conclusion, the study findings revealed that race/ethnicity did not contribute significantly to treatment according to the NCCN treatment guidelines. However, age at diagnosis was a consistent contributor across all groups. In addition, regional differences in treatment were found for some cancer patients. These findings provide a rationale for the need to strengthen the clinical research in elderly lung cancer patients to understand the best treatments for these patients and ways to improve compliance to the NCCN clinical guidelines that might improve quality of life, outcomes to treatment, and help in guiding the eradication of lung cancer. Further research is warranted to understand physician lack of compliance to clinical guidelines and factors contributing to why patients do not comply with physician treatment recommendations.

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Appendix

Letter of Permission

Sheridan
Ideas. Delivered.

April 6, 2018

Cheryl Mokrzecky
18484 Preston Road
#102
Dallas, TX 75252

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